



US009183646B2

(12) **United States Patent**
Nielsen et al.

(10) **Patent No.:** **US 9,183,646 B2**
(45) **Date of Patent:** **Nov. 10, 2015**

(54) **APPARATUS, SYSTEMS AND METHODS TO GENERATE ELECTRONIC RECORDS OF UNDERGROUND FACILITY MARKING OPERATIONS PERFORMED WITH GPS-ENABLED MARKING DEVICES**

(58) **Field of Classification Search**
CPC combination set(s) only.
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,986,777 A 10/1976 Roll
4,623,282 A * 11/1986 Allen 405/157
4,688,921 A 8/1987 Wakabayashi

(Continued)

FOREIGN PATENT DOCUMENTS

CA 2386200 4/2000
CA 2418157 7/2004

(Continued)

OTHER PUBLICATIONS

S&N Locating Services, LLC's and S&N Communications, Inc.'s Second Amended answer, Affirmative Defenses, and Counterclaims to Plaintiff's First Amended Complaint filed Jun. 12, 2015; Case No. 2:13-cv-346 (MSD) (TEM); *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

(Continued)

Primary Examiner — Anand Bhatnagar

(71) Applicant: **CertusView Technologies, LLC**, Palm Beach Gardens, FL (US)
(72) Inventors: **Steven E. Nielsen**, North Palm Beach, FL (US); **Curtis Chambers**, Palm Beach Gardens, FL (US); **Jeffrey Farr**, Royal Palm Beach, FL (US)

(73) Assignee: **CertusView Technologies, LLC**, Palm Beach Gardens, FL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/708,530**

(22) Filed: **May 11, 2015**

(65) **Prior Publication Data**

US 2015/0243054 A1 Aug. 27, 2015

Related U.S. Application Data

(63) Continuation of application No. 13/950,655, filed on Jul. 25, 2013, which is a continuation of application No. 13/796,487, filed on Mar. 12, 2013, now Pat. No. 8,532,341, which is a continuation of application No.

(Continued)

(51) **Int. Cl.**
G06K 9/00 (2006.01)
G06T 11/00 (2006.01)

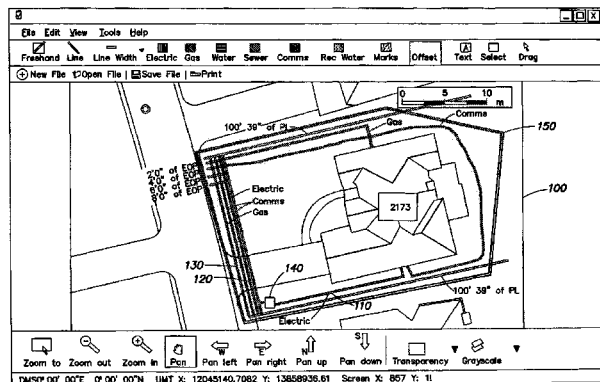
(Continued)

(52) **U.S. Cl.**
CPC **G06T 11/001** (2013.01); **G06K 9/0063** (2013.01); **G06K 9/3208** (2013.01); **G06T 11/60** (2013.01); **G06K 2009/3225** (2013.01)

(57) **ABSTRACT**

A technician performs a locate operation of an underground utility in a dig area of proposed excavation by applying one or more physical colored markers (e.g., paint, flags, other colored markers) to ground, pavement or other surface to indicate a presence or an absence of the underground utility in the dig area. A digital image of a geographic area comprising the dig area is displayed on a display device, and one or more electronic colored markers corresponding to the physical colored marker(s) are added to the displayed digital image so as to generate a marked-up image. Information relating to the marked-up image is electronically transmitted and/or electronically stored so as to document the locate operation.

20 Claims, 16 Drawing Sheets



Related U.S. Application Data

13/625,436, filed on Sep. 24, 2012, now Pat. No. 8,630,463, which is a continuation of application No. 12/369,232, filed on Feb. 11, 2009, now Pat. No. 8,290,204, which is a continuation-in-part of application No. 12/029,732, filed on Feb. 12, 2008, now Pat. No. 8,532,342, and a continuation-in-part of application No. 12/366,853, filed on Feb. 6, 2009, now Pat. No. 8,280,117, which is a continuation-in-part of application No. 12/050,555, filed on Mar. 18, 2008, now Pat. No. 8,249,306.

(51) **Int. Cl.****G06T 11/60**

(2006.01)

G06K 9/32

(2006.01)

(56)

References Cited

U.S. PATENT DOCUMENTS

5,414,462 A 5/1995 Veatch
 5,448,263 A 9/1995 Martin
 5,576,973 A 11/1996 Haddy
 5,644,237 A 7/1997 Eslambolchi et al.
 5,689,415 A 11/1997 Calotychos et al.
 5,699,244 A 12/1997 Clark, Jr.
 5,815,411 A 9/1998 Ellenby
 5,920,194 A 7/1999 Lewis et al.
 5,987,380 A 11/1999 Backman
 5,991,694 A 11/1999 Gudat et al.
 6,101,087 A 8/2000 Sutton
 6,127,827 A 10/2000 Lewis
 6,141,000 A 10/2000 Martin
 6,195,922 B1 3/2001 Stump
 6,201,883 B1 3/2001 Mizui
 6,299,934 B1 10/2001 Manning
 6,337,681 B1 1/2002 Martin
 6,351,707 B1 2/2002 Ichikawa
 6,371,692 B1 4/2002 Fatigati
 6,421,725 B1 7/2002 Vermilyea et al.
 6,426,872 B1 7/2002 Sutton
 6,430,499 B1 8/2002 Nakano
 6,437,708 B1 8/2002 Brouwer
 6,477,475 B1 11/2002 Takaoka et al.
 6,493,650 B1 12/2002 Rodgers
 6,567,116 B1 5/2003 Aman et al.
 6,597,992 B2 7/2003 Rooney et al.
 6,650,293 B1 11/2003 Eslambolchi
 6,650,834 B2 11/2003 Ume
 6,701,647 B2 3/2004 Stump
 6,710,741 B2 3/2004 Tucker
 6,723,375 B2 4/2004 Zeck et al.
 6,747,636 B2 6/2004 Martin
 6,751,552 B1 6/2004 Minelli
 6,751,553 B2 * 6/2004 Young et al. 702/5
 6,751,554 B1 * 6/2004 Asher et al. 702/5
 6,772,142 B1 8/2004 Kelling et al.
 6,778,128 B2 8/2004 Tucker et al.
 6,798,379 B2 * 9/2004 Tucker et al. 342/357.31
 6,803,906 B1 10/2004 Morrison et al.
 6,850,161 B1 * 2/2005 Elliott et al. 340/572.1
 6,853,905 B2 2/2005 Barton
 6,873,998 B1 3/2005 Dorum
 6,895,356 B2 5/2005 Brimhall
 6,898,525 B1 5/2005 Minelli
 6,904,361 B1 6/2005 Tallman et al.
 6,941,890 B1 9/2005 Cristo et al.
 6,950,535 B2 9/2005 Sibayama
 6,956,524 B2 * 10/2005 Tucker et al. 342/357.31
 6,957,250 B1 10/2005 Nakano
 6,958,690 B1 10/2005 Asher et al.
 6,972,698 B2 12/2005 Deguchi
 6,975,942 B2 12/2005 Young et al.
 6,999,021 B2 2/2006 Taylor, Jr.
 7,003,138 B2 2/2006 Wilson

7,009,399 B2 3/2006 Olsson et al.
 7,027,653 B2 4/2006 Hino
 7,120,564 B2 10/2006 Pacey
 7,142,196 B1 11/2006 Connor
 7,185,021 B2 2/2007 Kishigami
 7,216,034 B2 5/2007 Vitikainen
 7,222,986 B2 5/2007 Mah
 7,236,162 B2 6/2007 Morrison et al.
 7,262,797 B2 8/2007 Weldum
 7,274,756 B2 9/2007 Kuijk
 7,372,247 B1 5/2008 Giusti et al.
 7,400,976 B2 * 7/2008 Young et al. 702/5
 7,417,641 B1 8/2008 Barber
 7,437,830 B1 10/2008 Kulavic
 7,469,247 B2 12/2008 Cossins et al.
 7,482,973 B2 * 1/2009 Tucker et al. 342/357.48
 7,584,123 B1 9/2009 Karonis et al.
 7,613,331 B2 11/2009 Maeda
 7,626,496 B1 12/2009 Asher et al.
 7,636,901 B2 12/2009 Munson
 7,640,105 B2 12/2009 Nielsen et al.
 7,664,530 B2 2/2010 Skelton
 7,773,095 B1 8/2010 Badrak et al.
 7,777,648 B2 8/2010 Smith et al.
 7,834,806 B2 * 11/2010 Tucker et al. 342/357.64
 7,886,616 B1 2/2011 Hayman
 7,889,124 B2 2/2011 Islam et al.
 7,889,888 B2 2/2011 Deardorff et al.
 7,917,292 B1 3/2011 Du
 7,978,129 B2 7/2011 Sawyer et al.
 7,990,151 B2 * 8/2011 Olsson et al. 324/326
 8,045,995 B2 10/2011 King
 8,054,343 B2 11/2011 Cheatle et al.
 8,060,304 B2 11/2011 Nielsen et al.
 8,081,112 B2 * 12/2011 Tucker et al. 342/459
 8,144,058 B2 * 3/2012 Sawyer et al. 342/459
 8,150,826 B2 4/2012 Arrouye et al.
 8,155,390 B2 4/2012 Nielsen et al.
 8,194,932 B2 6/2012 Nielsen et al.
 8,204,642 B2 6/2012 Tanaka et al.
 8,218,827 B2 7/2012 Nielsen et al.
 8,249,306 B2 8/2012 Nielsen et al.
 8,260,489 B2 9/2012 Nielsen et al.
 8,265,344 B2 9/2012 Nielsen et al.
 8,270,666 B2 9/2012 Nielsen et al.
 8,280,117 B2 10/2012 Nielsen et al.
 8,280,631 B2 10/2012 Nielsen et al.
 8,280,969 B2 10/2012 Nielsen et al.
 8,290,204 B2 10/2012 Nielsen et al.
 8,290,215 B2 10/2012 Nielsen et al.
 8,296,308 B2 10/2012 Nielsen et al.
 8,300,895 B2 10/2012 Nielsen et al.
 8,300,925 B2 10/2012 Kunieda
 8,301,380 B2 10/2012 Nielsen et al.
 8,311,765 B2 11/2012 Nielsen et al.
 8,340,359 B2 12/2012 Nielsen et al.
 8,355,542 B2 1/2013 Nielsen et al.
 8,356,255 B2 1/2013 Nielsen et al.
 8,361,543 B2 1/2013 Nielsen et al.
 8,374,789 B2 2/2013 Nielsen et al.
 8,384,742 B2 2/2013 Nielsen et al.
 8,386,178 B2 2/2013 Nielsen et al.
 8,401,791 B2 3/2013 Nielsen et al.
 8,407,001 B2 3/2013 Nielsen et al.
 8,416,995 B2 4/2013 Nielsen et al.
 8,457,893 B2 6/2013 Nielsen et al.
 8,463,487 B2 6/2013 Nielsen et al.
 8,467,932 B2 6/2013 Nielsen et al.
 8,467,969 B2 6/2013 Nielsen et al.
 8,468,206 B2 6/2013 Nielsen et al.
 8,473,148 B2 6/2013 Nielsen et al.
 8,473,209 B2 6/2013 Nielsen et al.
 8,476,906 B2 7/2013 Nielsen et al.
 8,478,523 B2 7/2013 Nielsen et al.
 8,478,524 B2 7/2013 Nielsen et al.
 8,478,525 B2 7/2013 Nielsen et al.
 8,478,617 B2 7/2013 Nielsen et al.
 8,478,635 B2 7/2013 Nielsen et al.
 8,480,332 B2 7/2013 Miller

(56)

References Cited

U.S. PATENT DOCUMENTS

8,484,300	B2	7/2013	Nielsen et al.	2005/0034074	A1	2/2005	Munson
8,532,341	B2	9/2013	Nielsen et al.	2005/0046584	A1	3/2005	Breed
8,532,342	B2	9/2013	Nielsen et al.	2005/0057745	A1	3/2005	Bontje
8,540,141	B2	9/2013	Nielsen et al.	2005/0104775	A1	5/2005	Tucker et al.
8,543,651	B2	9/2013	Nielsen et al.	2005/0122518	A1	6/2005	Overbeck et al.
8,543,937	B2	9/2013	Nielsen et al.	2005/0125389	A1	6/2005	Hazzard et al.
8,549,084	B2	10/2013	Nielsen et al.	2005/0183028	A1	8/2005	Clough et al.
8,560,164	B2	10/2013	Nielsen et al.	2005/0192752	A1	9/2005	Rooney
8,566,737	B2	10/2013	Nielsen et al.	2005/0203768	A1	9/2005	Florance
8,572,193	B2	10/2013	Nielsen et al.	2005/0219268	A1	10/2005	Kyle
8,577,707	B2	11/2013	Nielsen et al.	2005/0254704	A1	11/2005	Komiya et al.
8,583,264	B2	11/2013	Nielsen et al.	2006/0020417	A1	1/2006	Koch et al.
8,583,372	B2	11/2013	Nielsen et al.	2006/0058945	A1	3/2006	Watanabe
8,589,201	B2	11/2013	Nielsen et al.	2006/0077095	A1	4/2006	Tucker et al.
8,589,202	B2	11/2013	Nielsen et al.	2006/0085396	A1	4/2006	Evans
8,600,526	B2	12/2013	Nielsen et al.	2006/0091888	A1	5/2006	Holman et al.
8,600,848	B2	12/2013	Nielsen et al.	2006/0161349	A1	7/2006	Cross
8,612,090	B2	12/2013	Nielsen et al.	2006/0229809	A1	10/2006	Chen
8,612,148	B2	12/2013	Nielsen et al.	2006/0235741	A1	10/2006	Deaton et al.
8,612,271	B2	12/2013	Nielsen et al.	2006/0239560	A1	10/2006	Sternby
8,612,276	B1	12/2013	Nielsen et al.	2006/0282191	A1	12/2006	Gotfried
8,620,572	B2	12/2013	Nielsen et al.	2006/0282280	A1	12/2006	Stotz et al.
8,620,587	B2	12/2013	Nielsen et al.	2007/0011271	A1	1/2007	Baker et al.
8,620,616	B2	12/2013	Nielsen et al.	2007/0027591	A1	2/2007	Goldenberg
8,620,726	B2	12/2013	Nielsen et al.	2007/0031029	A1	2/2007	Sasaki
8,626,571	B2	1/2014	Nielsen et al.	2007/0076920	A1	4/2007	Ofek
8,630,463	B2	1/2014	Nielsen et al.	2007/0100768	A1	5/2007	Boccon-Gibod et al.
8,644,965	B2	2/2014	Nielsen et al.	2007/0110316	A1	5/2007	Ohashi
8,700,325	B2	4/2014	Nielsen et al.	2007/0118278	A1	5/2007	Finn et al.
8,731,830	B2	5/2014	Nielsen et al.	2007/0143676	A1	6/2007	Chen
8,805,640	B2	8/2014	Nielsen et al.	2007/0182721	A1	8/2007	Watanabe et al.
8,830,265	B2	9/2014	Nielsen et al.	2007/0187574	A1	8/2007	Lia
8,861,794	B2	10/2014	Nielsen et al.	2007/0219722	A1	9/2007	Sawyer, Jr.
8,861,795	B2	10/2014	Nielsen et al.	2007/0258642	A1	11/2007	Thota
8,902,251	B2	12/2014	Nielsen et al.	2007/0286021	A1	12/2007	Hoenmans et al.
8,907,978	B2	12/2014	Nielsen et al.	2008/0021863	A1	1/2008	Evans et al.
8,907,980	B2	12/2014	Nielsen et al.	2008/0025614	A1	1/2008	Hintz et al.
8,917,228	B2	12/2014	Liu	2008/0059889	A1	3/2008	Parker et al.
8,917,288	B2	12/2014	Nielsen et al.	2008/0075368	A1	3/2008	Kuzmin
8,918,898	B2	12/2014	Nielsen et al.	2008/0109751	A1	5/2008	Fitzmaurice et al.
8,928,693	B2	1/2015	Nielsen et al.	2008/0125942	A1	5/2008	Tucker et al.
8,934,678	B2	1/2015	Nielsen et al.	2008/0180322	A1	7/2008	Islam
8,938,366	B2	1/2015	Nielsen et al.	2008/0192235	A1	8/2008	Komiya et al.
8,965,700	B2	2/2015	Nielsen et al.	2008/0208415	A1	8/2008	Vik
8,977,558	B2	3/2015	Nielsen et al.	2008/0284902	A1	11/2008	Konno et al.
8,990,100	B2	3/2015	Nielsen et al.	2008/0285805	A1	11/2008	Luinge et al.
2001/0036295	A1	11/2001	Hendrickson	2008/0288267	A1	11/2008	Asher
2001/0049470	A1	12/2001	Mault et al.	2008/0292295	A1	11/2008	Konno et al.
2002/0013704	A1	1/2002	Finney	2009/0004410	A1	1/2009	Thomson et al.
2002/0044690	A1	4/2002	Burgess	2009/0012418	A1	1/2009	Gerlach et al.
2002/0052755	A1	5/2002	Whatley	2009/0013806	A1	1/2009	Miller et al.
2002/0059296	A1	5/2002	Hayashi et al.	2009/0067695	A1	3/2009	Komiya et al.
2002/0122119	A1	9/2002	Takakura	2009/0070071	A1	3/2009	Wood
2002/0145617	A1	10/2002	Kennard	2009/0092297	A1	4/2009	Kitoh et al.
2002/0184235	A1	12/2002	Young	2009/0100185	A1	4/2009	Shehan et al.
2003/0012411	A1*	1/2003	Sjostrom et al. 382/109	2009/0121933	A1	5/2009	Tucker et al.
2003/0095708	A1	5/2003	Pittel	2009/0121937	A1	5/2009	Kaegebein
2003/0110184	A1	6/2003	Gibson et al.	2009/0185712	A1	7/2009	Wong et al.
2003/0164053	A1	9/2003	Ignagni	2009/0201311	A1	8/2009	Nielsen et al.
2003/0222815	A1	12/2003	Tucker	2009/0204238	A1	8/2009	Nielsen et al.
2004/0006425	A1	1/2004	Wood	2009/0204466	A1	8/2009	Nielsen et al.
2004/0008883	A1	1/2004	Shi et al.	2009/0207019	A1	8/2009	Nielsen et al.
2004/0073578	A1	4/2004	Nam	2009/0210285	A1	8/2009	Nielsen et al.
2004/0146185	A1	7/2004	Blair	2009/0210298	A1	8/2009	Nielsen et al.
2004/0148191	A1	7/2004	Hoke	2009/0237263	A1	9/2009	Sawyer, Jr. et al.
2004/0150556	A1	8/2004	Tucker et al.	2009/0237297	A1	9/2009	Davis et al.
2004/0151388	A1	8/2004	Maeda	2009/0257620	A1	10/2009	Hicks
2004/0168358	A1	9/2004	Stump	2009/0306881	A1	12/2009	Dolgov et al.
2004/0199410	A1	10/2004	Feyen et al.	2009/0322868	A1	12/2009	Ikeda
2004/0203909	A1	10/2004	Koster	2009/0327024	A1	12/2009	Nielsen et al.
2004/0210370	A1	10/2004	Gudat	2010/0006667	A1	1/2010	Nielsen et al.
2004/0210386	A1	10/2004	Wood	2010/0010862	A1	1/2010	Nielsen et al.
2004/0220731	A1	11/2004	Tucker	2010/0010863	A1	1/2010	Nielsen et al.
2004/0252303	A1	12/2004	Giorgianni et al.	2010/0010882	A1	1/2010	Nielsen et al.
2005/0033513	A1	2/2005	Gasbarro	2010/0010883	A1	1/2010	Nielsen et al.
				2010/0045517	A1	2/2010	Tucker et al.
				2010/0088134	A1	4/2010	Nielsen et al.
				2010/0088164	A1	4/2010	Nielsen et al.
				2010/0090700	A1	4/2010	Nielsen et al.

(56)

References Cited

U.S. PATENT DOCUMENTS

2010/0188088	A1	7/2010	Nielsen et al.
2010/0188407	A1	7/2010	Nielsen et al.
2010/0189312	A1	7/2010	Nielsen et al.
2010/0189887	A1	7/2010	Nielsen et al.
2010/0198663	A1	8/2010	Nielsen et al.
2010/0201690	A1	8/2010	Nielsen et al.
2010/0205031	A1	8/2010	Nielsen et al.
2010/0205032	A1	8/2010	Nielsen et al.
2010/0245086	A1	9/2010	Nielsen et al.
2010/0253511	A1	10/2010	Nielsen et al.
2010/0253513	A1	10/2010	Nielsen et al.
2010/0253514	A1	10/2010	Nielsen et al.
2010/0256981	A1	10/2010	Nielsen et al.
2010/0257029	A1	10/2010	Nielsen et al.
2010/0257477	A1	10/2010	Nielsen et al.
2010/0272885	A1	10/2010	Olsson
2010/0285211	A1	11/2010	Nielsen et al.
2010/0318401	A1	12/2010	Nielsen et al.
2010/0318402	A1	12/2010	Nielsen et al.
2010/0318465	A1	12/2010	Nielsen et al.
2011/0020776	A1	1/2011	Nielsen et al.
2011/0022433	A1	1/2011	Nielsen et al.
2011/0035245	A1	2/2011	Nielsen et al.
2011/0035251	A1	2/2011	Nielsen et al.
2011/0035252	A1	2/2011	Nielsen et al.
2011/0035260	A1	2/2011	Nielsen et al.
2011/0035324	A1	2/2011	Nielsen et al.
2011/0035328	A1	2/2011	Nielsen et al.
2011/0040589	A1	2/2011	Nielsen et al.
2011/0040590	A1	2/2011	Nielsen et al.
2011/0045175	A1	2/2011	Nielsen et al.
2011/0046993	A1	2/2011	Nielsen et al.
2011/0046994	A1	2/2011	Nielsen et al.
2011/0093306	A1	4/2011	Nielsen et al.
2011/0241936	A1	10/2011	Sawyer, Jr. et al.
2011/0279229	A1	11/2011	Nielsen et al.
2011/0279230	A1	11/2011	Nielsen et al.
2011/0283217	A1	11/2011	Nielsen et al.
2011/0285749	A1	11/2011	Nielsen et al.
2012/0036140	A1	2/2012	Nielsen et al.
2012/0065924	A1	3/2012	Nielsen et al.
2012/0065944	A1	3/2012	Nielsen et al.
2012/0066137	A1	3/2012	Nielsen et al.
2012/0066273	A1	3/2012	Nielsen et al.
2012/0069178	A1	3/2012	Nielsen et al.
2012/0072035	A1	3/2012	Nielsen et al.
2012/0110019	A1	5/2012	Nielsen et al.
2012/0113244	A1	5/2012	Nielsen et al.
2012/0257785	A1	10/2012	Narayan et al.
2012/0259550	A1	10/2012	Du
2012/0290901	A1	11/2012	Kim
2012/0328162	A1	12/2012	Nielsen et al.
2012/0330849	A1	12/2012	Nielsen et al.
2013/0174072	A9	7/2013	Nielsen et al.
2013/0265138	A1	10/2013	Nielsen et al.
2013/0287500	A1	10/2013	Miller
2013/0315449	A1	11/2013	Nielsen et al.
2013/0325542	A1	12/2013	Tucker et al.
2014/0022272	A1	1/2014	Nielsen et al.
2014/0035587	A1	2/2014	Nielsen et al.
2014/0074970	A1	3/2014	Nielsen et al.
2014/0122149	A1	5/2014	Nielsen et al.
2014/0278661	A1	9/2014	Nielsen et al.
2014/0321717	A1	10/2014	Nielsen et al.
2014/0334878	A1	11/2014	Miller
2014/0347396	A1	11/2014	Nielsen et al.
2015/0009608	A1	1/2015	Nielsen et al.
2015/0149242	A1	5/2015	Nielsen et al.
2015/0170089	A1	6/2015	Nielsen et al.

FOREIGN PATENT DOCUMENTS

CA	2423148	9/2004
CA	2574595	2/2006

CA	2811172	2/2006
CA	2528795	6/2007
CA	2632267	6/2007
CA	2643844	9/2007
CA	2739110	4/2010
CA	2713282	3/2013
EP	1769270	4/2007
WO	WO02067083	8/2002
WO	WO2005052627	6/2005
WO	WO2006014724	2/2006
WO	WO2007067898	6/2007
WO	WO2007106871	9/2007
WO	WO2008005837	1/2008

OTHER PUBLICATIONS

Notice of Filing of Defendants' Second Amended Answer and Counterclaims filed Jun. 12, 2015; Case No. 2:13-cv-346 (MSD) (TEM); *CertusView Technologies, LLC v. S&N Locating Services, LLC* et al., (Eastern District of Virginia).

Notice of Allowance dated Jun. 19, 2015 from U.S. Appl. No. 13/194,121.

Notice of Allowance dated Jun. 5, 2015 from U.S. Appl. No. 13/191,048.

Notice of Allowance dated Jun. 4, 2015 from U.S. Appl. No. 13/190,185.

Office Action dated May 15, 2015 from U.S. Appl. No. 14/194,718.

Office Action dated May 21, 2015 from U.S. Appl. No. 13/950,655.

First Action Interview Office Action dated Jun. 12, 2015 from U.S. Appl. No. 14/612,603.

U.S. 8,583,461, 04/2010, Nielsen et al. (withdrawn).

U.S. Appl. No. 14/194,718, filed Mar. 1, 2014, Nielsen et al.

U.S. Appl. No. 14/612,603, filed Feb. 3, 2015, Nielsen et al.

"Online Service, Software Enable Faster Data Collection," Mapping underground in real-time, Mar. 2007, pp. 18-19.

2001-2004 News, Jul. 5, 2004 City of Madison Implements TelDig Utility & TelDig Mobile, 12 pages.

ArcFM UT, "A GIS for Utilities Based on Standards," White Paper, AED SICAD, Sep. 2008, 1-28.

ArcFM, White Paper, 2006, 1-28.

ArcGIS 9, Geocoding in ArcGIS, Manual, 2004, 1-192.

ArcPad, Mobile GIS Software for Field Mapping Applications, brochure, 2006, <http://www.esri.com/library/brochures/pdfs/arcpadbro.pdf>.

ArcPad: Mobile GIS, ESRI White Paper, Sep. 2004, 1-17, <http://www.esri.com/library/whitepapers/pdfs/arcpad.pdf>.

Avoiding Utility Relocations, U.S. Department of Transportation Federal Highway Administration, Publication No. FHWA-IF-02-049, Jul. 2002, 128 pages.

Ayers, S., Technology Update, 21 pages.

Bernold, L.E. et al., "A Multi-Sensory Approach to 3-D Mapping of Underground Utilities," article by Bernold, Venkatesan, and Suvarna, pp. 1-6.

Binder 1: "Virginia Utility Protection Service, Inc. Response to US Patent Application Publication . . .," pp. DY0001-755, Nov. 3, 2010. Binder 2: "Patent US 2009 0237408," pp. DY0756-DY1271, Nov. 3, 2010.

Binder 3: "Patent US 2009 0238414," pp. DY1272-DY2210, Nov. 3, 2010.

Binder 4: "Patent US 2009 0238415," pp. DY2211-DY3308, Nov. 3, 2010.

Binder 5: "Patent US 2009 0238416," pp. DY3309-DY3889, Nov. 3, 2010.

Binder 6: "Patent US 2009 0238417," pp. DY3890-DY4133, Nov. 3, 2010.

Binder 7: "Patent US 2009 0241045," pp. DY4134-DY4276, Nov. 3, 2010.

Binder 8: "Patent US 2009 0241046," pp. DY4277-DY4499, Nov. 3, 2010.

Borsan, T. et al., "Setting Up a Database to Record Preventive and Salvage Archeological Excavations," article by Borsan, Ludsan, Dimen, Ienciu, and Oprea, Dec. 1, 1918, pp. 237-242.

CertusView's Objections to The Magistrate Judge's Order (Dkt. No. 248) Allowing S&N's Amended Answer and Counterclaims filed

(56)

References Cited

OTHER PUBLICATIONS

Feb. 2, 2015; Case No. 2:13-cv-346 (MSD) (TEM); *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

CertusView's Response in Opposition to S&N's Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 27, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

CGA, Common Ground Alliance, Best Practices, Version 1.0, Apr. 2003, 93 pages.

CGA, Common Ground, Study of One-Call Systems and Damage Prevention Best Practices, Aug. 1999, 262 pages.

Chhabra, K. "Integrated GIS Work Environment with Esri Products," A paper for the ESRI Users Conference 2004, 7 pages.

Chmura, A. "Project to Create GPS Excavation Monitoring System," Development of Encroachment Notification, Jul./Aug. 2008, 1 page.

Clark et al., "Using ArcPad," ArcPad 6, 398 pages.

Collection and Depiction of Existing Subsurface Utility Data, pp. 7-9.

Complaint for Patent Infringement dated Apr. 10, 2013, *CertusView Technologies LLC v. United States Infrastructure Corporation et al.*, Case No. 2:13CV182, USDC Eastern District of Virginia.

Complaint for Patent Infringement dated May 28, 2013, *CertusView Technologies LLC v. S&N Locating Services, LLC et al.*, Case No. 1:13CV346, USDC Eastern District of Virginia.

Corrected Notice of Allowability dated Apr. 25, 2014 from U.S. Appl. No. 13/191,048.

Corrected Notice of Allowability dated May 22, 2014 from U.S. Appl. No. 13/191,048.

Corrected Notice of Allowability dated May 22, 2014 from U.S. Appl. No. 13/191,058.

Corrected Notice of Allowability dated Nov. 10, 2014 from U.S. Appl. No. 13/741,080.

Corrected Notice of Allowability dated Aug. 21, 2012 from U.S. Appl. No. 12/369,565.

Corrected Notice of Allowability dated Feb. 27, 2014 from U.S. Appl. No. 13/191,058.

Cut Field-Mapping Time in Half Using Mobile GIS, Edgecomb County, 4 pages.

DigiTerra Explorer, brochure, v. 6, 2009, 1-2.

DigiTerra Explorer, User Manual, v. 5, 2007, 1-64.

Doyle, K., UGI Utilities: Delivering enhanced service, Energy Digital, <http://www.energydigital.com/company-report/ugi-utilities-delivering-enhanced-service> (original publication date unknown), retrieved Aug. 1, 2011, 3 pages.

Edgecomb County, North Carolina, Maps and Inventories Water/Wastewater Infrastructure with GIS and GPS, Field Mapping Time Cut in Half, 4 pages.

Eide, S.E. et al., "3D Utility Mapping Using Electronically Scanned Antenna Array," 9th International Conference on Ground Penetrating Radar, Apr. 29-May 2, 2002, 5 pages.

Examination Report dated Oct. 9, 2014 from Australian Application No. 2013204039.

Exhibit A to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.* (Eastern District of Virginia).

Exhibit J to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-1 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.* (Eastern District of Virginia).

Exhibit J-10 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb.

4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-11 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-12 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-13 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-14 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-15 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-16 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-17 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 04, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-18 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-19 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-2 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-20 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 04, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-21 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-22 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-23 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

(56)

References Cited**OTHER PUBLICATIONS**

Exhibit J-3 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.* (Eastern District of Virginia).

Exhibit J-4 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-5 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-6 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-7 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.* (Eastern District of Virginia).

Exhibit J-8 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Exhibit J-9 to Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Expert CV and Testimony of Ivan Zatkovich (10 pages); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Expert Report of Ivan Zatkovich Regarding the Invalidity of U.S. Pat. No. 8,265,344, 8,290,204, 8,340,359, 8,407,001, and 8,532,341, dated Sep. 3, 2014; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Farag, A., R&D for Damage Prevention, Damage Prevention Conference paper, Apr. 2008, 24 pages.

Georgia Underground Marking Standards, PSC Rule 515-9-4.14, published online May 2, 2008, http://www.gauipc.com/userfiles/file/Marking_Standards_Presentation_05_02_08.pdf.

GIS Best Practices, GIS for Public Works, Aug. 2006, 26 pages.

GIS Landbase Solutions, 2 pages.

GPS Technology Enhancing Underground Utility Locating, Underground Construction Magazine, Apr. 7, 2010, 4 pages, <http://www.undergroundconstructionmagazine.com/print/1034?page=show>.

Ground Penetrating Radar Systems webpage, Feb. 28, 2008, 3 pages.

H.L. Smith, Letter dated Jan. 14, 2011, with two attachments each dated Jan. 5, 2011.

H.L. Smith, Letter dated Oct. 27, 2010.

Haas, J. et al., "Feed the FLAME—Utility Integrates Field Applications," GeoWorld, Mar. 2007, 5 pages, online: Systems Integration Articles/Enspira Solutions.

Heath, M. et al., "Comparison of Edge Detectors: A Methodology and Initial Study," 1996, IEEE Computer Society Press; <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.45.5214>.

InMaps Develops Critical Database Link to Keep UGI Automation on Track, Holderness, NH, Sep. 2006, <http://www.inmaps.com/InMaps-develops-critical-database-link-to-keep-ugi-automation-on-track>, 1 page.

International Search Report and Written Opinion, Application No. PCT/US2009/000859, Apr. 14, 2009.

International Search Report, Application No. PCT/US10/041160, Oct. 6, 2010.

Invalidity Claim Chart—Application of TelDig Systems and ESRI to Claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 (Exhibit 9-A); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of TelDig Systems and ESRI to Claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 (Exhibit 9-B); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of TelDig Systems and ESRI to Claims 1, 3-7, 9-10, 12, 14, 16-20, 22-23, 25 and 28 of U.S. Pat. No. 8,532,341 (Exhibit 9-D); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of TelDig Systems and ESRI to Claims 1-2, 4-7, 10-15, 17-20, and 23-26 of U.S. Pat. No. 8,265,344 (Exhibit 9-C); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of TelDig Systems to Claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 (Exhibit 5-A); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of TelDig Systems to Claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 (Exhibit 5-C); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of TelDig Systems to Claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 (Exhibit 5-B); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of TelDig Systems to Claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 (Exhibit 5-E); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of TelDig Systems to Claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 (Exhibit 5-D); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II and Avoiding Utility Regulations to Claims 1, 3, 13-14, 16, 18, 22, and 27-30 of U.S. Pat. No. 8,407,001 (Exhibit 8-E); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II and Avoiding Utility Regulations to Claims 1, 3-7, 9-10, 12, 14, 16-20, 22-23, 25 and 28 of U.S. Pat. No. 8,532,341 (Exhibit 8-D); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II and Avoiding Utility Regulations to Claims 1-2, 17, 19-22, 40 and 42 of U.S. Pat. No. 8,290,204 (Exhibit 8-A); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II and Avoiding Utility Regulations to Claims 1-2, 4-7, 10-15, 17-20, and 23-26 of U.S. Pat. No. 8,265,344 (Exhibit 8-C); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II and Avoiding Utility Regulations to Claims 1-2, 5, 10, 12, 18, 20-21 and 23 of U.S. Pat. No. 8,340,359 (Exhibit 8-B); Case

(56)

References Cited**OTHER PUBLICATIONS**

2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia). Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II and WO 2008/005837 (Tucker '837) to Claims 1, 2, 17, 19, 20-22, 40 and 42 of U.S. Pat. No. 8,290,204 (Exhibit 10-A); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II and WO 2008/005837 (Tucker '837) to Claims 1, 3-7, 9-10, 12, 14, 16-20, 22-23, 25 and 28 of U.S. Pat. No. 8,532,341 (Exhibit 10-D); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II and WO 2008/005837 (Tucker '837) to Claims 1-2, 4-7, 10-15, 17-20, and 23-26 of U.S. Pat. No. 8,265,344 (Exhibit 10-C); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II and WO 2008/005837 (Tucker '837) to Claims 1-2, 5, 10, 12, 18, 20-21 and 23 of U.S. Pat. No. 8,340,359 (Exhibit 10-B); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II to Claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 (Exhibit 4-A); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II to Claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 (Exhibit 4-B); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II to Claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 (Exhibit 4-E); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II to Claims 1, 3-7, 9-10, 12, 14, 16-20, 22-23, 25, and 28 of U.S. Pat. No. 8,532,341 (Exhibit 4-D); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of Virginia Pilot Program—Phases I and II to Claims 1-2, 4-7, 10-15, 17-20, and 23-26 of U.S. Pat. No. 8,265,344 (Exhibit 4-C); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of WO 2007/106871 ("Tucker '871") to Claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 (Exhibit 2-A); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of WO 2007/106871 ("Tucker '871") to Claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 (Exhibit 2-B); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of WO 2007/106871 ("Tucker '871") to Claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 (Exhibit 2-E); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of WO 2007/106871 ("Tucker '871") to Claims 1, 3-7, 9-10, 12, 14, 16-20, 22-23, 25 and 28 of U.S. Pat. No. 8,532,341 (Exhibit 2-D); Case 2:13-cv-00346-MSD-

LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart—Application of WO 2007/106871 ("Tucker '871") to Claims 1-2, 4-7, 10-15, 1720, and 23-26 of U.S. Pat. No. 8,265,344 (Exhibit 2-C); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "3D Utility Mapping Electronically Scanned Antenna Array" by Egil Side and Jens F. Hjeltnstad (the "Eide" Reference) (Exhibit 51-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "A Multi-Sensory Approach to 3-D Mapping of Underground Utilities" by Leonard E. Bernold and Lashminarayan Venkatesan (hereinafter referred to as the "Bernold" reference) (Exhibit 49-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "New Approaches for Preventing Damage to Gas and Oil Pipelines," article by Joe Zhou for Canberra Joint Technical Meeting (Exhibit 16-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "New Approaches for Preventing Damage to Gas and Oil Pipelines," presentation by Joe Zhou at Canberra Joint Technical Meeting (Exhibit 15-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "Online Service, Software Enable Faster Data Collection" article in Underground Focus (Mar. 2007) (Exhibit 8-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "Project to Create GPS Excavation Monitoring System," Underground Focus (Exhibit 24-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "Merging Two GIS Platforms for Utility Data into One: FRAMME to ESRI Conversion and all of the other pieces and parts" (2005) (Exhibit 53-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "Using I.T. To Improve the Efficiency and Accuracy of Network Data Collection," IEEE AFRICON, Rex van Olst and Barry Dwolatzky (Exhibit 37-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of an Investigation of Geobase Mission Data Set Design, Implementation, & Usage Within Air Force Civil Engineer Electrical and Utilities Work Centers (Exhibit 36-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of ArcGIS Software (2000) (Exhibit 59-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

(56)

References Cited**OTHER PUBLICATIONS**

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of ArcIMS Software (2000) (Exhibit 56-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of ArcPad 6 Software (2000) (Exhibit 58-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Article titled "Setting Up a Database to Record Preventative and Salvage Archeological Excavations," by Borsan, Ludusan, Dimen, Ienciu, and Oprea (hereinafter referred to as "Borsan") (Exhibit 48-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Edgcombe County, Cut Field-Mapping Time in Half Using Mobile GIS (Exhibit 25-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Geographic Location Tags on Digital Images (Exhibit 50-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of GIS for Public Works Presentation (Aug. 2006) (Exhibit 54-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Go! Sync™ Software (2005) (Exhibit 57-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Guardian ProStar/ProStar Data Collection Software (PointMan and/or Predator Products (Oct. 15, 2006) (Exhibit 3-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Guardian ProStar/ProStar Mapping Components (Oct. 15, 2006) (Exhibit 7-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Guardian ProStar/ProStar Web Portal (Oct. 15, 2006) (Exhibit 5-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Guardian ProStar/ProStar Web Services (Oct. 15, 2006) (Exhibit 4-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of OnPoint Software (2005) (Exhibit 55-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Phase I—Electronic White Lining Project Report (Nov. 2007) (Exhibit 17-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Technologies to Accurately and Cost-Effectively Detect and Identify Unauthorized Activity Near Pipelines (Exhibit 18-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Triangulation, <http://searchnetworking.techtarget.com/definition/triangulation> (Exhibit 14-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Tucker References (Exhibit 2-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services* (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of U.S. Department of Transportation Federal Highway Administration, Publication No. FHWA-IF-02-049 (Exhibit 12-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of U.S. Pat. No. 7,372,276 (Exhibit 43-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of U.S. Patent Publication No. 2002/0059296 (Exhibit 45-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of U.S. Pub. No. 2005/0183028A1 (Aug. 18, 2005) (Exhibit 41-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of US 2002/0044690 (Exhibit 47-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of US 2007/0118278 (Exhibit 33-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of US 2012/0259550 (Exhibit 29-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of U.S. Pat. No. 8,150,826 (Exhibit 30-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Virginia Pilot Program—Phases I and II (Exhibit 1-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "Finding Buried Utilities Before They Find You," article by Daniel P. Duffy (Exhibit 13-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED

(56)

References Cited**OTHER PUBLICATIONS**

CertusView Technologies, LLC v. S&N Locating Services; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "GRISLEE: Gasmain Repair & Inspection System for Live Entry Environments," article by Schempf, Mutschler, Goltsberg, and Crowley (Exhibit 39-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "Introduction to ArcPad Mobile GIS," Gregory Vandeberg, Ph.D., presentation at ND GIS Users Conference (Exhibit 26-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of "Using ArcPad," ArcPad 6, Clarke, Greenwald, and Spalding (Exhibit 27-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of a Data Platform for Managing Utilities Along Highway Corridors (Exhibit 35-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Common Ground—Study of One-Call Systems and Damage Prevention Best Practices ("Common Ground") (Exhibit 52-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Empowering Electric and Gas Utilities with Gis (Exhibit 40-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Integrated GIS Work Environment With ESRI Products, Paper for ESRI Users Conference 2004 (Exhibit 28-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of Intelligent Utility Locating Tool for Excavators, Kolera and Bernold (Exhibit 38-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of U.S. Pat. No. 6,701,647 (Mar. 9, 2004) (Exhibit 42-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of U.S. Pat. No. 5,991,694 (Gudat) (Exhibit 34-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of U.S. Pat. No. 6,957,250 (hereinafter referred to as "Nakano") (Exhibit 44-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of US 2004/0168358 (Exhibit 31-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED

CertusView Technologies, LLC v. S&N Locating Services; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of U.S. Pat. No. 6,597,992 (Exhibit 32-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of US 2007/0258642 (Exhibit 46-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 of Guardian ProStar/ProStar Data Services (Oct. 15, 2006) (Exhibit 6-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 17, 19, 20, 21, 22, 40 and 42 of U.S. Pat. No. 8,290,204 in view of American Society of Civil Engineers Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data ("ASCE") (Exhibit 11-A); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Guardian ProStar/ProStar Web Portal (Oct. 15, 2006) (Exhibit 5-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of "3D Utility Mapping Electronically Scanned Antenna Array" by Egil Side and Jens F. Hjelmstad (the "Eide" Reference) (Exhibit 51-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of "A Multi-Sensory Approach to 3-D Mapping of Underground Utilities" by Leonard E. Bernold and Lashminarayan Venkatesan (hereinafter referred to as the "Bernold" reference) (Exhibit 49-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of "Finding Buried Utilities Before They Find You," article by Daniel P. Duffy (Exhibit 13-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of "GRISLEE: Gasmain Repair & Inspection System for Live Entry Environments," article by Schempf, Mutschler, Goltsberg, and Crowley (Exhibit 39-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of "Introduction to ArcPad Mobile Gis," Gregory Vandeberg, Ph.D., presentation at ND GIS Users Conference (Exhibit 26-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of "Merging Two GIS Platforms for Utility Data into One: Framme to ESRI Conversion and all of the other pieces and parts" (2005) (Exhibit 53-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

(56)

References Cited**OTHER PUBLICATIONS**

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of "Project to Create GPS Excavation Monitoring System," Underground Focus (Exhibit 24-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of "Using ArcPad," ArcPad 6, Clarke, Greenwald, and Spalding (Exhibit 27-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of "Using I.T. To Improve the Efficiency and Accuracy of Network Data Collection," IEEE AFRICON, Rex van Olst and Barry Dwolatzky (Exhibit 37-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of a Data Platform for Managing Utilities Along Highway Corridors (Exhibit 35-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of an Investigation of Geobase Mission Data Set Design, Implementation, & Usage Within Air Force Civil Engineer Electrical and Utilities Work Centers (Exhibit 36-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of ArcGIS Software (2000) (Exhibit 59-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of ArcIMS Software (2000) (Exhibit 56-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of ArcPad 6 Software (2000) (Exhibit 58-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Article titled "Setting Up a Database to Record Preventative and Salvage Archeological Excavations," by Borsan, Ludusan, Dimen, Ienciu, and Oprea (hereinafter referred to as "Borsan") (Exhibit 48-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Common Ground—Study of One-Call Systems and Damage Prevention Best Practices ("Common Ground") (Exhibit 52-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Edgecombe County, Cut Field-Mapping Time in Half Using Mobile GIS (Exhibit 25-C); S&N Invalidity Contentions; Case 2:13-cv-

00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Empowering Electric and Gas Utilities with GIS (Exhibit 40-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Geographic Location Tags on Digital Images (Exhibit 50-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of GIS for Public Works Presentation (Aug. 2006) (Exhibit 54-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Go! Sync™ Software (2005) (Exhibit 57-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Integrated GIS Work Environment With ESRI Products, Paper for ESRI Users Conference 2004 (Exhibit 28-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Intelligent Utility Locating Tool for Excavators, Kolera and Bernold (Exhibit 38-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of OnPoint Software (2005) (Exhibit 55-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of U.S. Pat. No. 6,701,647 (Mar. 9, 2004) (Exhibit 42-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of U.S. Pat. No. 5,991,694 (Gudat) (Exhibit 34-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of U.S. Pat. No. 6,957,250 (hereinafter referred to as "Nakano") (Exhibit 44-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of U.S. Pat. No. 7,372,276 (Exhibit 43-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of U.S. Patent Publication No. 2002/0059296 (Exhibit 45-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED

(56)

References Cited**OTHER PUBLICATIONS**

CertusView Technologies, LLC v. S&N Locating Services; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of U.S. Pub. No. 2005/0183028A1 (Aug. 18, 2005) (Exhibit 41-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of US 2002/0044690 (Exhibit 47-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of US 2004/0168358 (Exhibit 31-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of US 2007/0118278 (Exhibit 33-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of US 2007/0258642 (Exhibit 46-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of US 2012/0259550 (Exhibit 29-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of U.S. Pat. No. 6,597,992 (Exhibit 32-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of U.S. Pat. No. 8,150,826 (Exhibit 30-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of “New Approaches for Preventing Damage to Gas and Oil Pipelines,” article by Joe Zhou for Canberra Joint Technical Meeting (Exhibit 16-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of “Online Service, Software Enable Faster Data Collection” article in Underground Focus (Mar. 2007) (Exhibit 8-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of American Society of Civil Engineers Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (“ASCE”) (Exhibit 11-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Guardian ProStar/ProStar Data Collection Software (PointMan and/

or Predator Products) (Oct. 15, 2006) (Exhibit 3-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Guardian ProStar/ProStar Data Services (Oct. 15, 2006) (Exhibit 6-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Guardian ProStar/ProStar Mapping Components (Oct. 15, 2006) (Exhibit 7-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Guardian ProStar/ProStar Web Services (Oct. 15, 2006) (Exhibit 4-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of New Approaches for Preventing Damage to Gas and Oil Pipelines, presentation by Joe Zhou at Canberra Joint Technical Meeting (Exhibit 15-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Phase I—Electronic White Lining Project Report (Nov. 2007) (Exhibit 17-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Technologies to Accurately and Cost-Effectively Detect and Identify Unauthorized Activity Near Pipelines (Exhibit 18-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Triangulation, <http://searchnetworking.techtarget.com/definition/triangulation> (Exhibit 14-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Tucker References (Exhibit 2-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services* (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of U.S. Department of Transportation Federal Highway Administration, Publication No. FHWA-IF-02-049 (Exhibit 12-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15, 17, 18, 19, 20, 23, 24, 25 and 26 of U.S. Pat. No. 8,265,344 in view of Virginia Pilot Program—Phases I and II (Exhibit 1-C); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of “3D Utility Mapping Electronically Scanned Antenna Array” by Egil Side and Jens F. Hjelmsstad (the “Eide” Reference) (Exhibit 51-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

(56)

References Cited**OTHER PUBLICATIONS**

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of "A Multi-Sensory Approach to 3-D Mapping of Underground Utilities" by Leonard E. Bernold and Lashminarayan Venkatesan (hereinafter referred to as the "Bernold" reference) (Exhibit 49-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of "New Approaches for Preventing Damage to Gas and Oil Pipelines," article by Joe Zhou for Canberra Joint Technical Meeting (Exhibit 16-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of "New Approaches for Preventing Damage to Gas and Oil Pipelines," presentation by Joe Zhou at Canberra Joint Technical Meeting (Exhibit 15-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of "Online Service, Software Enable Faster Data Collection" article in Underground Focus (Mar. 2007) (Exhibit 8-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of "Finding Buried Utilities Before They Find You," article by Daniel P. Duffy (Exhibit 13-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of "GRISLEE: Gasmain Repair & Inspection System for Live Entry Environments," article by Schempff, Mutschler, Goltsberg, and Crowley (Exhibit 39-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of "Merging Two GIS Platforms for Utility Data into One: FRAMME to ESRI Conversion and all of the other pieces and parts" (2005) (Exhibit 53-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of "Project to Create GPS Excavation Monitoring System," Underground Focus (Exhibit 24-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of "Using I.T. To Improve the Efficiency and Accuracy of Network Data Collection," IEEE AFRICON, Rex van Olst and Barry Dwolatzky (Exhibit 37-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of American Society of Civil Engineers Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data ("ASCE") (Exhibit 11-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of an Investigation of Geobase

Mission Data Set Design, Implementation, & Usage Within Air Force Civil Engineer Electrical and Utilities Work Centers (Exhibit 36-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of ArcGIS Software (2000) (Exhibit 59-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of ArcIMS Software (2000) (Exhibit 56-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of ArcPad 6 Software (2000) (Exhibit 58-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Article titled "Setting Up a Database to Record Preventative and Salvage Archeological Excavations," by Borsan, Ludusan, Dimen, Ienciu, and Oprea (hereinafter referred to as "Borsan") (Exhibit 48-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Common Ground—Study of One-Call Systems and Damage Prevention Best Practices ("Common Ground") (Exhibit 52-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Edgecombe County, Cut Field-Mapping Time in Half Using Mobile GIS (Exhibit 25-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Geographic Location Tags on Digital Images (Exhibit 50-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of GIS for Public Works Presentation (Aug. 2006) (Exhibit 54-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Go! Sync™ Software (2005) (Exhibit 57-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Guardian ProStar/ProStar Data Collection Software (PointMan and/or Predator Products) (Oct. 15, 2006) (Exhibit 3-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services* (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Guardian ProStar/ProStar Data Services (Oct. 15, 2006) (Exhibit 6-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Guardian ProStar/ProStar Mapping Components (Oct. 15, 2006) (Exhibit 7-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

(56)

References Cited**OTHER PUBLICATIONS**

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Guardian ProStar/ProStar Web Portal (Oct. 15, 2006) (Exhibit 5-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Guardian ProStar/ProStar Web Services (Oct. 15, 2006) (Exhibit 4-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Intelligent Utility Locating Tool for Excavators, Kolera and Bernold (Exhibit 38-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of OnPoint Software (2005) (Exhibit 55-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Phase I—Electronic White Lining Project Report (Nov. 2007) (Exhibit 17-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Technologies to Accurately and Cost-Effectively Detect and Identify Unauthorized Activity Near Pipelines (Exhibit 18-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Triangulation, <http://searchnetworking.techtarget.com/definition/triangulation> (Exhibit 14-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of U.S. Department of Transportation Federal Highway Administration, Publication No. FHWA-IF-02-049 (Exhibit 12-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of U.S. Pat. No. 6,701,647 (Mar. 9, 2004) (Exhibit 42-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of U.S. Pat. No. 6,957,250 (hereinafter referred to as “Nakano”) (Exhibit 44-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of U.S. Pat. No. 7,372,276 (Exhibit 43-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of U.S. Patent Publication No. 2002/0059296 (Exhibit 45-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of U.S. Pub. No. 2005/0183028A1 (Aug. 18, 2005) (Exhibit 41-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of US 2002/0044690 (Exhibit 47-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of US 2007/0118278 (Exhibit 33-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of US 2007/0258642 (Exhibit 46-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of US 2012/0259550 (Exhibit 29-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of U.S. Pat. No. 6,597,992 (Exhibit 32-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of U.S. Pat. No. 8,150,826 (Exhibit 30-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Virginia Pilot Program—Phases I and II (Exhibit 1-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of “Introduction to ArcPad Mobile GIS,” Gregory Vandeberg, Ph.D., presentation at ND GIS Users Conference (Exhibit 26-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of “Using ArcPad,” ArcPad 6, Clarke, Greenwald, and Spalding (Exhibit 27-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of A Data Platform for Managing Utilities Along Highway Corridors (Exhibit 35-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Empowering Electric and Gas Utilities with GIS (Exhibit 40-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Integrated GIS Work Environment With ESRI Products, Paper for ESRI Users Conference 2004 (Exhibit 28-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of U.S. Pat. No. 5,991,694 (Gudat) (Exhibit 34-B); S&N Invalidity Contentions; Case 2:13-cv-00346-

(56)

References Cited**OTHER PUBLICATIONS**

MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 20, 21 and 23 of U.S. Pat. No. 8,340,359 in view of US 2004/0168358 (Exhibit 31-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 2, 5, 10, 12, 18, 21 and 23 of U.S. Pat. No. 8,340,359 in view of Tucker References (Exhibit 2-B); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services* (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "Finding Buried Utilities Before They Find You," article by Daniel P. Duffy (Exhibit 13-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "New Approaches for Preventing Damage to Gas and Oil Pipelines," presentation by Joe Zhou at Canberra Joint Technical Meeting (Exhibit 15-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "Online Service, Software Enable Faster Data Collection" article in Underground Focus (Mar. 2007) (Exhibit 8-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of American Society of Civil Engineers Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data ("ASCE") (Exhibit 11-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Guardian ProStar/ProStar Data Collection Software (PointMan and/or Predator Products) (Oct. 15, 2006) (Exhibit 3-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Guardian ProStar/ProStar Data Services (Oct. 15, 2006) (Exhibit 6-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Guardian ProStar/ProStar Mapping Components (Oct. 15, 2006) (Exhibit 7-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Guardian ProStar/ProStar Web Portal (Oct. 15, 2006) (Exhibit 5-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Guardian ProStar/ProStar Web Services (Oct. 15, 2006) (Exhibit 4-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Phase I—Electronic White Lining Project Report (Nov. 2007) (Exhibit 17-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Technologies to Accurately and Cost-Effectively Detect and Identify Unauthorized Activity Near Pipelines (Exhibit 18-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Triangulation, <http://searchnetworking.techtarget.com/definition/triangulation> (Exhibit 14-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Tucker References (Exhibit 2-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "New Approaches for Preventing Damage to Gas and Oil Pipelines," article by Joe Zhou for Canberra Joint Technical Meeting (Exhibit 16-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "Project to Create GPS Excavation Monitoring System," Underground Focus (Exhibit 24-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of OnPoint Software (2005) (Exhibit 55-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "3D Utility Mapping Electronically Scanned Antenna Array" by Egil Side and Jens F. Hjelmstad (the "Eide" Reference) (Exhibit 51-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "A Multi-Sensory Approach to 3-D Mapping of Underground Utilities" by Leonard E. Bernold and Lashminarayan Venkatesan (hereinafter referred to as the "Bernold" reference) (Exhibit 49-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "GRISLEE: Gasmain Repair & Inspection System for Live Entry Environments," article by Schempf, Mutschler, Goltsberg, and Crowley (Exhibit 39-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "Introduction to ArcPad Mobile GIS," Gregory Vandeberg, Ph.D., presentation at ND GIS Users Conference (Exhibit 26-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29 and 30 of U.S. Pat. No. 8,407,001 in view of "Merging Two GIS Platforms for Utility Data into One: FRAMME to ESRI Conversion and all of the other pieces and parts" (2005) (Exhibit 53-E); S&N

(56)

References Cited**OTHER PUBLICATIONS**

Invalidity Contentions; Case 2:13-cv-00346-MSD- LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of "Using ArcPad," ArcPad 6, Clarke, Greenwald, and Spalding (Exhibit 27-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of "Using I.T. To Improve the Efficiency and Accuracy of Network Data Collection," IEEE AFRICON, Rex van Olst and Barry Dwolatzky (Exhibit 37-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of a Data Platform for Managing Utilities Along Highway Corridors (Exhibit 35-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of An Investigation of Geobase Mission Data Set Design, Implementation, & Usage Within Air Force Civil Engineer Electrical and Utilities Work Centers (Exhibit 36-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of ArcGIS Software (2000) (Exhibit 59-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of ArcIMS Software (2000) (Exhibit 56-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of ArcPad 6 Software (2000) (Exhibit 58-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of Article titled "Setting Up a Database to Record Preventative and Salvage Archeological Excavations," by Borsan, Ludusan, Dimen, Ienciu, and Oprea (hereinafter referred to as "Borsan") (Exhibit 48-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of Common Ground—Study of One-Call Systems and Damage Prevention Best Practices ("Common Ground") (Exhibit 52-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of Edgecombe County, Cut Field-Mapping Time in Half Using Mobile GIS (Exhibit 25-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of Empowering Electric and Gas Utilities with GIS (Exhibit 40-E); S&N Invalidity Con-

tions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of Geographic Location Tags on Digital Images (Exhibit 50-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of GIS for Public Works Presentation (Aug. 2006) (Exhibit 54-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of Go! Sync™ Software (2005) (Exhibit 57-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of Integrated GIS Work Environment With ESRI Products, Paper for ESRI Users Conference 2004 (Exhibit 28-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of Intelligent Utility Locating Tool for Excavators, Kolera and Bernold (Exhibit 38-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of U.S. Department of Transportation Federal Highway Administration, Publication No. FHWA-IF-02-049 (Exhibit 12-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of U.S. Pat. No. 6,701,647 (Mar. 9, 2004) (Exhibit 42-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of U.S. Pat. No. 5,991,694 (Gudat) (Exhibit 34-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of U.S. Pat. No. 6,957,250 (hereinafter referred to as "Nakano") (Exhibit 44-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of U.S. Pat. No. 7,372,276 (Exhibit 43-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of U.S. Patent Publication No. 2002/0059296 (Exhibit 45-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of U.S. Pub. No. 2005/0183028A1 (Aug. 18, 2005) (Exhibit 41-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of US 2002/0044690

(56)

References Cited**OTHER PUBLICATIONS**

(Exhibit 47-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of US 2004/0168358 (Exhibit 31-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of US 2007/0118278 (Exhibit 33-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of US 2007/0258642 (Exhibit 46-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of US 2012/0259550 (Exhibit 29-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of U.S. Pat. No. 6,597,992 (Exhibit 32-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 28, 29, and 30 of U.S. Pat. No. 8,407,001 in view of U.S. Pat. No. 8,150,826 (Exhibit 30-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 13, 14, 16, 18, 22, 27, 29 and 30 of U.S. Pat. No. 8,407,001 in view of Virginia Pilot Program—Phases I and II (Exhibit 1-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “New Approaches for Preventing Damage to Gas and Oil Pipelines,” presentation by Joe Zhou at Canberra Joint Technical Meeting (Exhibit 15-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “3D Utility Mapping Electronically Scanned Antenna Array” by Egil Side and Jens F. Hjelmstad (the “Eide” Reference) (Exhibit 51-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “A Multi-Sensory Approach to 3-D Mapping of Underground Utilities” by Leonard E. Bernold and Lashminarayan Venkatesan (hereinafter referred to as the “Bernold” reference) (Exhibit 49-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “Finding Buried Utilities Before They Find You,” article by Daniel P. Duffy (Exhibit 13-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “New Approaches for Preventing Damage to Gas and Oil Pipelines,”

article by Joe Zhou for Canberra Joint Technical Meeting (Exhibit 16-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “Online Service, Software Enable Faster Data Collection” article in Underground Focus (Mar. 2007) (Exhibit 8-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “Project to Create GPS Excavation Monitoring System,” Underground Focus (Exhibit 24-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “GRISLEE: Gasmain Repair & Inspection System for Live Entry Environments,” article by Schempf, Mutschler, Goltsberg, and Crowley (Exhibit 39-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “Introduction to ArcPad Mobile GIS,” Gregory Vandenberg, Ph.D., presentation at ND GIS Users Conference (Exhibit 26-E); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “Merging Two GIS Platforms for Utility Data into One: FRAMME to ESRI Conversion and all of the other pieces and parts” (2005) (Exhibit 53-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “Using ArcPad,” ArcPad 6, Clarke, Greenwald, and Spalding (Exhibit 27-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of “Using I.T. to Improve the Efficiency and Accuracy of Network Data Collection,” IEEE AFRICON, Rex van Olst and Barry Dwolatzky (Exhibit 37-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of A Data Platform for Managing Utilities Along Highway Corridors (Exhibit 35-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of American Society of Civil Engineers Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data (“ASCE”) (Exhibit 11-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of an Investigation of Geobase Mission Data Set Design, Implementation, & Usage Within Air Force Civil Engineer Electrical and Utilities Work Centers (Exhibit 36-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
 Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of

(56)

References Cited**OTHER PUBLICATIONS**

ArcGIS Software (2000) (Exhibit 59-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of ArcIMS Software (2000) (Exhibit 56-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of ArcPad 6 Software (2000) (Exhibit 58-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Article titled “Setting Up a Database to Record Preventative and Salvage Archeological Excavations,” by Borsan, Ludusan, Dimen, Ienciu, and Oprea (hereinafter referred to as “Borsan”) (Exhibit 48-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Common Ground—Study of One-Call Systems and Damage Prevention Best Practices (“Common Ground”) (Exhibit 52-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Edgecombe County, Cut Field-Mapping Time in Half Using Mobile GIS (Exhibit 25-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Empowering Electric and Gas Utilities with GIS (Exhibit 40-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Geographic Location Tags on Digital Images (Exhibit 50-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of GIS for Public Works Presentation (Aug. 2006) (Exhibit 54-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Go! Sync™ Software (2005) (Exhibit 57-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Guardian ProStar/ProStar Data Collection Software (PointMan and/or Predator Products) (Oct. 15, 2006) (Exhibit 3-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Guardian ProStar/ProStar Data Services (Oct. 15, 2006) (Exhibit 6-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Guardian ProStar/ProStar Mapping Components (Oct. 15, 2006) (Exhibit 7-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Guardian ProStar/ProStar Web Portal (Oct. 15, 2006) (Exhibit 5-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Guardian ProStar/ProStar Web Services (Oct. 15, 2006) (Exhibit 4-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Integrated GIS Work Environment With ESRI Products, Paper for ESRI Users Conference 2004 (Exhibit 28-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Intelligent Utility Locating Tool for Excavators, Kolera and Bernold (Exhibit 38-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of OnPoint Software (2005) (Exhibit 55-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Phase I—Electronic White Lining Project Report (Nov. 2007) (Exhibit 17-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Technologies to Accurately and Cost-Effectively Detect and S&N. Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Triangulation, <http://searchnetworking.techtarget.com/definition/triangulation> (Exhibit 14-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Tucker References (Exhibit 2-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services* (Eastern District of Virginia).

Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of U.S. Department of Transportation Federal Highway Administration, Publication No. FHWA-IF-02-049 (Exhibit 12-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

(56)

References Cited**OTHER PUBLICATIONS**

- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of U.S. Pat. No. 6,701,647 (Mar. 9, 2004) (Exhibit 42-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of U.S. Pat. No. 5,991,694 (Gudat) (Exhibit 34-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of U.S. Pat. No. 7,372,276 (Exhibit 43-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of U.S. Pat. No. 6,957,250 (hereinafter referred to as "Nakano") (Exhibit 44-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of U.S. Patent Publication No. 2002/0059296 (Exhibit 45-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of US 2002/0044690 (Exhibit 47-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of US 2004/0168358 (Exhibit 31-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of US 2007/0118278 (Exhibit 33-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of US 2007/0258642 (Exhibit 46-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of US 2012/0259550 (Exhibit 29-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of U.S. Pat. No. 6,597,992 (Exhibit 32-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of U.S. Pat. No. 8,150,826 (Exhibit 30-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Invalidity Claim Chart for claims 1, 3, 4, 5, 6, 7, 9, 10, 12, 14, 16, 17, 18, 19, 20, 22, 23, 25 and 28 of U.S. Pat. No. 8,532,341 in view of Virginia Pilot Program—Phases I and II (Exhibit 1-D); S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).
- Kolera, B.T. et al., "Intelligent Utility Locating Tool for Excavators," *Journal of Construction Engineering and Management*, Sep. 2006, pp. 919-927.
- Letter from Norfield Data Products to Wolf Greenfield & Sacks, P.C., May 5, 2010, 2 pages.
- Loeber, P.C., "An Investigation of Geobase Mission Data Set Design, Implementation, and Usage Within Air Force Civil Engineer Electrical and Utilities Work Centers," Msgrt, USAF, Mar. 2005, 139 pages.
- Maps joining tickets on Arkups' computers in trucks, ARKUPS, Jan., Feb., Mar., 2003, 2 pages.
- Meehan, B., "Empowering Electric and Gas Utilities with GIS," 264 pages.
- Memorandum of Law in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Feb. 4, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).
- Memorandum Order regarding Functional Equivalency Objections and Sanctions Objections filed Mar. 11, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).
- Miss Utility webpage, Dec. 30, 2007, 2 pages.
- Mobile Computing Makes its Move on Utility Field Automation, Mar. 1, 1996, 6 pages.
- MobileMapper 6 vs. Juno SC in Real World Conditions, White Paper, 2009 1-16, http://www.sidwellco.com/php/gps_solutions/docs/MM6_vs_Juno_WP_en.pdf.
- MobileMapper 6, brochure, 2008, 1-4.
- New Breakthroughs in GIS/GPS Technology Focus on Underground Utility Damage Prevention, Press Release, Jan. 27, 2003, 2 pages.
- New Technologies Virginia Pilot Project Phases I, II and III, 38 pages.
- Notice of Allowability dated Jul. 26, 2013 from U.S. Appl. No. 13/796,487.
- Notice of Allowance dated Jan. 14, 2015 from U.S. Appl. No. 13/194,121.
- Notice of Allowance dated Jan. 31, 2013 from U.S. Appl. No. 12/363,046.
- Notice of Allowance dated Feb. 2, 2015 from U.S. Appl. No. 13/190,185.
- Notice of Allowance dated Feb. 2, 2015 from U.S. Appl. No. 13/194,163.
- Notice of Allowance dated Feb. 10, 2014 from U.S. Appl. No. 13/758,336.
- Notice of Allowance dated Feb. 14, 2014 from U.S. Appl. No. 13/741,080.
- Notice of Allowance dated Feb. 18, 2014 from U.S. Appl. No. 13/193,337.
- Notice of Allowance dated Apr. 3, 2014 from U.S. Appl. No. 12/831,330.
- Notice of Allowance dated Apr. 30, 2012 from U.S. Appl. No. 12/208,846.
- Notice of Allowance dated Jun. 6, 2013 from U.S. Appl. No. 13/796,487.
- Notice of Allowance dated Jul. 3, 2014 from U.S. Appl. No. 13/758,336.
- Notice of Allowance dated Jul. 11, 2012 from U.S. Appl. No. 12/366,050.
- Notice of Allowance dated Jul. 18, 2014 from U.S. Appl. No. 13/193,337.
- Notice of Allowance dated Jul. 19, 2013 from U.S. Appl. No. 13/734,415.
- Notice of Allowance dated Jul. 23, 2012 from U.S. Appl. No. 12/369,565.

(56)

References Cited

OTHER PUBLICATIONS

- Notice of Allowance dated Jul. 26, 2013 from U.S. Appl. No. 12/029,732.
- Notice of Allowance dated Aug. 4, 2014 from U.S. Appl. No. 13/741,080.
- Notice of Allowance dated Aug. 13, 2014 from U.S. Appl. No. 12/831,330.
- Notice of Allowance dated Aug. 18, 2014 from U.S. Appl. No. 13/190,138.
- Notice of Allowance dated Aug. 21, 2012 from U.S. Appl. No. 12/369,232.
- Notice of Allowance dated Sep. 2, 2014 from U.S. Appl. No. 13/191,058.
- Notice of Allowance dated Sep. 11, 2013 from U.S. Appl. No. 13/191,048.
- Notice of Allowance dated Sep. 12, 2014 from U.S. Appl. No. 13/191,048.
- Notice of Allowance dated Sep. 13, 2013 from U.S. Appl. No. 13/625,436.
- Notice of Allowance dated Sep. 23, 2014 from U.S. Appl. No. 14/063,417.
- Notice of Allowance dated Oct. 1, 2012 from U.S. Appl. No. 12/607,843.
- Notice of Allowance dated Oct. 25, 2012 from U.S. Appl. No. 12/639,373.
- Notice of Allowance dated Nov. 7, 2012 from U.S. Appl. No. 12/639,041.
- Notice of Allowance dated Nov. 16, 2012 from U.S. Appl. No. 12/208,846.
- Notice of Allowance dated Dec. 6, 2013 from U.S. Appl. No. 13/191,048.
- Notice of Allowance dated Dec. 13, 2011 from U.S. Appl. No. 12/369,565.
- Notice of Allowance dated Dec. 20, 2013 from U.S. Appl. No. 13/191,058.
- Notice of Allowance dated Oct. 6, 2011 from Canadian Application No. 2,715,312.
- Office Action dated Jan. 2, 2013 from U.S. Appl. No. 12/363,009.
- Office Action dated Jan. 7, 2015 from U.S. Appl. No. 13/185,194.
- Office Action dated Jan. 15, 2013 from U.S. Appl. No. 12/029,732.
- Office Action dated Jan. 20, 2012 from U.S. Appl. No. 13/190,138.
- Office Action dated Feb. 4, 2013 from Australian Application No. 2010270589.
- Office Action dated Feb. 4, 2013 from Canadian Application No. 2,707,246.
- Office Action dated Feb. 5, 2014 from U.S. Appl. No. 13/185,194.
- Office Action dated Feb. 12, 2013 from U.S. Appl. No. 12/833,117.
- Office Action dated Feb. 16, 2012 from U.S. Appl. No. 12/369,232.
- Office Action dated Feb. 29, 2012 from U.S. Appl. No. 12/833,117.
- Office Action dated Mar. 2, 2012 from U.S. Appl. No. 12/831,330.
- Office Action dated Mar. 8, 2012 from U.S. Appl. No. 13/190,185.
- Office Action dated Mar. 19, 2012 from U.S. Appl. No. 12/208,846.
- Office Action dated Mar. 25, 2015 from U.S. Appl. No. 14/063,417.
- Office Action dated Apr. 5, 2012 from U.S. Appl. No. 13/191,048.
- Office Action dated Apr. 6, 2012 from U.S. Appl. No. 13/191,058.
- Office Action dated Apr. 11, 2012 from U.S. Appl. No. 12/029,732.
- Office Action dated Apr. 17, 2012 from U.S. Appl. No. 12/607,843.
- Office Action dated Apr. 22, 2013 from U.S. Appl. No. 13/734,415.
- Office Action dated Apr. 23, 2012 from U.S. Appl. No. 12/366,050.
- Office Action dated Apr. 23, 2013 from U.S. Appl. No. 13/191,048.
- Office Action dated Apr. 25, 2012 from U.S. Appl. No. 12/363,046.
- Office Action dated May 1, 2012 from U.S. Appl. No. 12/363,009.
- Office Action dated May 7, 2012 from U.S. Appl. No. 13/193,337.
- Office Action dated May 7, 2013 from U.S. Appl. No. 13/191,058.
- Office Action dated May 20, 2013 from U.S. Appl. No. 13/741,080.
- Office Action dated May 24, 2012 from U.S. Appl. No. 13/190,138.
- Office Action dated May 24, 2012 from U.S. Appl. No. 13/194,121.
- Office Action dated May 28, 2013 from U.S. Appl. No. 13/193,337.
- Office Action dated Jun. 8, 2012 from U.S. Appl. No. 13/194,163.
- Office Action dated Jun. 23, 2011 from U.S. Appl. No. 12/208,846.
- Office Action dated Jun. 28, 2012 from U.S. Appl. No. 12/369,565.
- Office Action dated Jul. 1, 2013 from U.S. Appl. No. 12/029,732.
- Office Action dated Jul. 3, 2013 from Canadian Application No. 2,707,246.
- Office Action dated Jul. 3, 2013 from U.S. Appl. No. 13/758,336.
- Office Action dated Jul. 13, 2011 from U.S. Appl. No. 12/029,732, filed Feb. 12, 2008.
- Office Action dated Jul. 17, 2012 from U.S. Appl. No. 12/369,232.
- Office Action dated Jul. 18, 2014 from U.S. Appl. No. 13/185,194.
- Office Action dated Jul. 26, 2012 from Canadian Application No. 2,707,246.
- Office Action dated Jul. 30, 2014 from U.S. Appl. No. 13/194,121.
- Office Action dated Aug. 1, 2013 from U.S. Appl. No. 13/190,138.
- Office Action dated Aug. 7, 2012 from U.S. Appl. No. 13/190,185.
- Office Action dated Aug. 9, 2012 from U.S. Appl. No. 12/831,330.
- Office Action dated Aug. 26, 2014 from Canadian Application No. 2,707,246.
- Office Action dated Sep. 4, 2013 from U.S. Appl. No. 12/363,009.
- Office Action dated Sep. 19, 2014 from U.S. Appl. No. 13/194,163.
- Office Action dated Oct. 4, 2011 from Canadian Application No. 2,707,246.
- Office Action dated Oct. 9, 2012 from U.S. Appl. No. 13/190,138.
- Office Action dated Oct. 10, 2012 from U.S. Appl. No. 13/191,048.
- Office Action dated Oct. 10, 2012 from U.S. Appl. No. 13/191,058.
- Office Action dated Oct. 10, 2014 from U.S. Appl. No. 13/190,185.
- Office Action dated Oct. 31, 2013 from U.S. Appl. No. 13/953,998.
- Office Action dated Nov. 4, 2013 from U.S. Appl. No. 13/193,337.
- Office Action dated Nov. 4, 2013 from U.S. Appl. No. 13/758,336.
- Office Action dated Nov. 6, 2013 from U.S. Appl. No. 13/741,080.
- Office Action dated Nov. 21, 2012 from U.S. Appl. No. 13/194,121.
- Office Action dated Nov. 23, 2011 from U.S. Appl. No. 12/208,846.
- Office Action dated Nov. 23, 2011 from U.S. Appl. No. 12/363,009.
- Office Action dated Nov. 27, 2012 from U.S. Appl. No. 13/194,163.
- Office Action dated Dec. 12, 2014 from Canadian Application No. 2,707,246.
- Office Action dated Dec. 28, 2012 from U.S. Appl. No. 13/193,337.
- Office Action dated Dec. 30, 2013 from Canadian Application No. 2,707,246.
- Office Action dated Nov. 26, 2010 from Australian Application No. 2009213151.
- Office Action dated Nov. 29, 2011 from Australian Application No. 2009213151.
- Office Action dated Oct. 6, 2011 from U.S. Appl. No. 12/366,050.
- Olst, R. van, "Using I.T. To improve the efficiency and accuracy of Network Data Collection," IEEE AFRICON 2004, pp. 927-932.
- One Call Concepts Locating Services, Inc., Point Positive Utility Mapping & GIS, <http://www.occls.com/Default.aspx?content=pointpositive>, original publication date unknown, retrieved Sep. 21, 2011, 1 page.
- One Call Technology Pilot Project, 41 pages.
- One Call Technology Pilot Project, Trimble Meeting, Aug. 25, 2006, 5 pages.
- Opinion and Order Following Markman Hearing, May 16, 2014; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; (Eastern District of Virginia).
- Opinion and Order Following Motion for Judgment on Pleadings, Jan. 21, 2015; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; (Eastern District of Virginia).
- Patent Examination Report No. 1 dated Jan. 21, 2014 from Australian Application No. 2012241082.
- Pevarski, R., Virginia Pilot Project: Technology Meets Damage Prevention, http://www.excavationsafetyonline.com/esg/guidePDFs/2009_2009_ESG_Page_9.pdf, printed on Nov. 3, 2009, 1 page.
- Pickering, D. et al., "Utility Mapping and Record Keeping for Infrastructure," Urban Management Programme, 1946, 84 pages.
- Plaintiff *CertusView Technologies, LLC's* Claim Construction Reply Brief dated Mar. 21, 2014, *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, Case No. 2:13-cv-346, USDC Eastern District of Virginia.
- Preliminary Proposed Claim Constructions and Identification of Structure(s), Act(s), or Material(s) Corresponding to Claims Gov-

(56)

References Cited**OTHER PUBLICATIONS**

erned by 35 U.S.C. § 112(6), *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, Case No. 2:13-cv-346, USDC Eastern District of Virginia.

Preliminary Proposed Constructions dated Feb. 14, 2014, *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, Case No. 2:13-cv-346, USDC Eastern District of Virginia.

Prior Art Table; S&N Invalidity Contentions; Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Progress Energy Chooses MapFrame's FieldSmart Software for Mobile Mapping & Field Automation, *IntelligentUtility*, Jul. 17, 2003, 3 pages.

Project Plan, VA Pilot Project, Draft, Aug. 24, 2009, 15 pages.

Quiroga, C. et al., "A Data Platform for Managing Utilities Along Highway Corridors," Project No. 0-2110, Report 2110-1, Texas Transportation Institute, Feb. 2002, 88 pages.

R. Pevarski, Letter from the Virginia Utility Protection Service, Inc., dated Apr. 7, 2010.

Reply in Support of Defendants' Motion for Exceptional Case Finding and Attorneys' Fees filed Mar. 9, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Ross, C., "2d Tile Map Editor," Oct. 19, 2005, <http://www.blitzbasic.com/Community/posts.php?topic=52152>, pp. 1-3.

Ruggiero, K., "Using ArcGIS for Clearing Cable Locates," ESRI 2006.

S&N Locating Services, LLC's and S&N Communications, Inc.'s First Amended Answer, Affirmative Defenses, and Counterclaims to Plaintiff's First Amended Complaint filed Jan. 23, 2015; Case No. 2:13-cv-346 (MSD) (TEM); *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

S&N Location Services, LLC and S&N Communication, Inc.'s Opening Claim Construction Brief dated Mar. 18, 2014, *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, Case No. 2:13-cv-346, USDC Eastern District of Virginia.

S&N Location Services, LLC and S&N Communication, Inc.'s Reply Claim Construction Brief dated Mar. 21, 2014, *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, Case No. 2:13-cv-346, USDC Eastern District of Virginia.

Schempf, H. et al., "Grislee: Gasmain Repair & Inspection System for Live Entry Environments," article by Schempf, Mutschler, Goltsberg, and Crowley, 12 pages.

Sentinel USA Announces New Alliance with Guardian Angel Protection, Press Release: Jan. 26, 2003, 2 pages.

Stahovich, David M. et al., "Automated and Integrated Call Before You Dig," Proceedings of GITA 2005, GITA's 28th Annual Conference, Mar. 6-9, 2005, Denver, CO, online: GIS for Oil & Gas Conference 2002 <<http://www.gisdevelopment.net/proceedings/gita/2005/papers/76.pdf>>.

Supplemental Notice of Allowability dated Jul. 2, 2013 from U.S. Appl. No. 13/796,487.

Supplemental Notice of Allowability dated Dec. 4, 2014 from U.S. Appl. No. 14/063,417.

Supplemental Notice of Allowance dated Jul. 27, 2012 from U.S. Appl. No. 12/366,050.

Tel-Dig Junior—The most advanced system on earth—and below Brochure (5 pages) (Exhibit 7); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

TelDig Mobile, Locate ticket-receiving software for remote users, p. 1.

TelDig Mobile, Locate ticket-receiving software for remote users, p. 2.

Tel-Dig One Call Brochure (1 page) (Exhibit 6); Case 2:13-cv-00346-MSD-LRLVAED *CertusView Technologies, LLC v. S&N Locating Services*; Apr. 29, 2014 (Eastern District of Virginia).

Toyama, K. et al., "Geographic Location Tags on Digital Images," article by Toyama, Logan, Roseway, and Anandan, pp. 156-166.

Trimble Comprehensive Utilities, brochure, 2010, 1-6.

UGI Utilities Selects KEMA for FLAME Project Implementation, Burlington, Massachusetts, Electric Energy Publications, Inc., Feb. 10, 2004, http://www.eet-d.com/?page=show_news&id=17641, 2 pages.

UGI Utilities, Inc., FLAME Project White Paper, (original publication date unknown), 12 pages.

Ultimate Utility Management System to be Unveiled at Planet Underground, The Planet Underground, 2 pages.

Underground Facility Damage Prevention, Virginia's Pilot Program for One-call Location Technology Business Case, Jun. 2006, 37 pages.

Underground Utility Damage Prevention, Virginia's Pilot Program, Jan. 2006, 15 pages.

Underground, pages from magazine, Jan./Feb. 2003 issue, 4 pages.

Utility Notification Center webpage, Mar. 4, 2008, 2 pages.

Utility Sciences Corporation to Attend Trade Show, SpatialNews.com Press Release, 2 pages.

Vanaartsen, S.J., GIS Automates Utility One Call Process, Proceeding ESRI, 1-15, http://proceedings.esri.com/library/useconf/proc06/papers/papers/pap_1148.pdf.

Vandeberg, G., "Introduction to ArcPad: Mobile GIS," ND GIS Users Conference, Oct. 26, 2006, 30 pages.

Virginia Damage Prevention Conference Agenda, Apr. 20-22, 2010, 6 pages.

Virginia Damage Prevention Conference Agenda, Apr. 21-23, 2009, 5 pages.

Virginia Damage Prevention Conference Agenda, Apr. 8-10, 2008, 5 pages.

Virginia Pilot Project, Incorporating GPS Technology to Enhance One-Call Damage Prevention, Phase I—Electronic White Lining Project Report, Nov. 2007, 41 pages.

Virginia Pilot Project, Incorporating GPS Technology to Enhance One-Call Damage Prevention, Phase I—Electronic White Lining Project Report, Nov. 2007, 50 pages.

Virginia Utility Projection Service, Inc. (VUPS), Project Proposal to: U.S. Department of Transportation Pipeline & Hazardous Materials Safety Administration, Phase II of the Virginia Pilot Program Electronic Manifests, Jul. 31, 2007, 16 pages.

w3schools; "JavaScript Pop Up Boxes," Aug. 11, 2005; http://www.w3schools.com/js/js_popup.asp, pp. 1-2.

CertusView's Reply in Support of its Motion to Strike and in the Alternative Dismiss S&N's First Amended Answer and Counterclaims filed Mar. 2, 2015; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

CertusView's Request for Leave to File a Sur-Reply in Support of its Opposition to Defendants' Motion for Attorneys Fees filed Mar. 18, 2015; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Defendants' Response to CertusView's Motion to Strike and in the Alternative Dismiss S&N's First Amended Answer and Counterclaims filed Feb. 23, 2015; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Defendants' Response to CertusView's Objections to the Magistrate Judge's Order (Dkt. 248) Allowing S&N's Amended Answer and Counterclaims filed Feb. 17, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Defendant's Response to CertusView's Objections to the Magistrate Judge's Order (Dkt. No. 254) Awarding Sanctions on S&N's Motion to Compel filed Feb. 23, 2015; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Responsive Expert Report of Dr. Randel Dymond, P.E. to the Expert Report of Mr. Ivan Zatkovich dated Sep. 30, 2014, filed Nov. 13, 2014; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Opinion and Order to Plaintiffs Rule 72 Objections to the Magistrate Judge's Jan. 16, 2015 Order Granting Defendant's Leave to Amend their Answer and Counterclaims, and on Plaintiff's Motion to Strike and in the Alternative Dismiss S&N's First Amended Answer and Counterclaims, filed May 22, 2015; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

Nielsen et al., co-pending U.S. Publication No. 2014, published Jan. 23, 2014.

(56)

References Cited

OTHER PUBLICATIONS

Office Action dated Jul. 15, 2015 from U.S. Appl. No. 13/185,194.
 Notice of Allowance dated Jul. 7, 2015 from U.S. Appl. No. 14/612,603.
 Potts, A., "ArcInfo Version 8: Introducing the Next Generation," ArcUser Magazine (Apr.-Jun. 1999), 4 pages.
 ESRI Press Release. Redlands, California. Jan. 2000, 3 pages.
 "Features and Functions of ArcInfo 8," ESRI. Redlands, California, Sep. 1999, 18 pages.
 Memorandum in Support of CertusView's Motion for Summary Judgment on S&N's Inequitable Conduct Counterclaims filed Jul. 22, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technolo-*

gies, LLC v. S&N Locating Services, LLC et al., (Eastern District of Virginia) (Parts 1, 2, 3 and 4).
 Memorandum in Support of S&N's Response to CertusView's Motion for Summary Judgment on S&N's Inequitable Conduct Counterclaims filed Jul. 29, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).
 CertusView's Reply in Support of its Motion for Summary Judgment on S&N's Inequitable Conduct Counterclaims filed Aug. 3, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).
 Memorandum Order filed Aug. 7, 2015; Case 2:13-cv-00346-MSD-TEM; *CertusView Technologies, LLC v. S&N Locating Services, LLC et al.*, (Eastern District of Virginia).

* cited by examiner

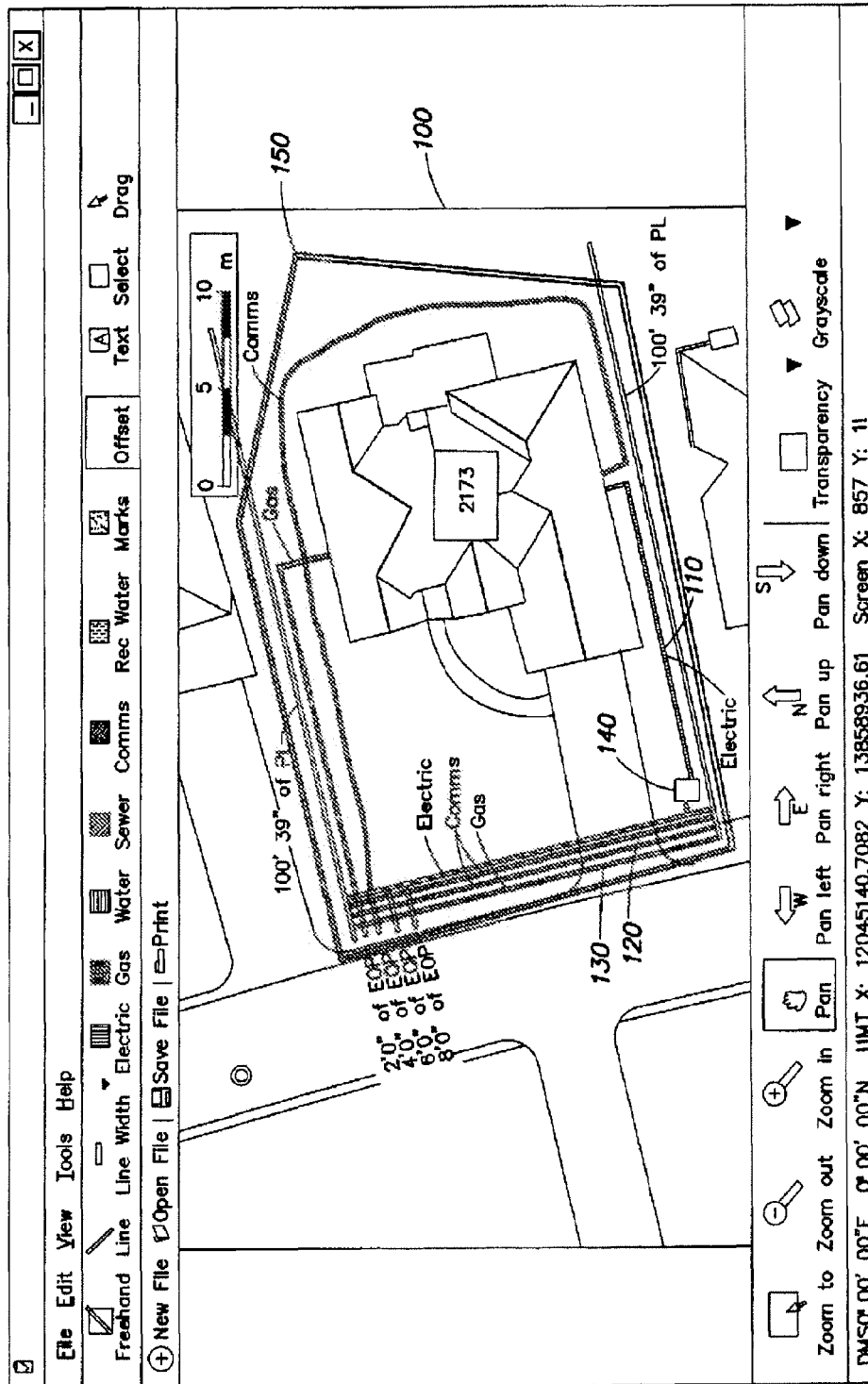


FIG. 1

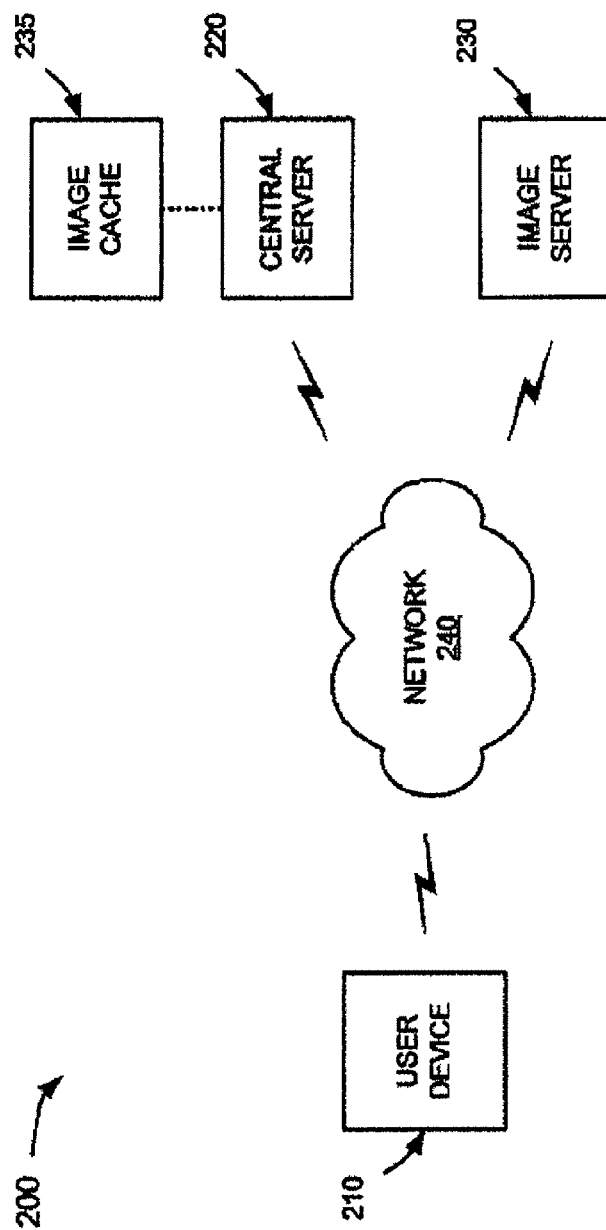


FIG. 2

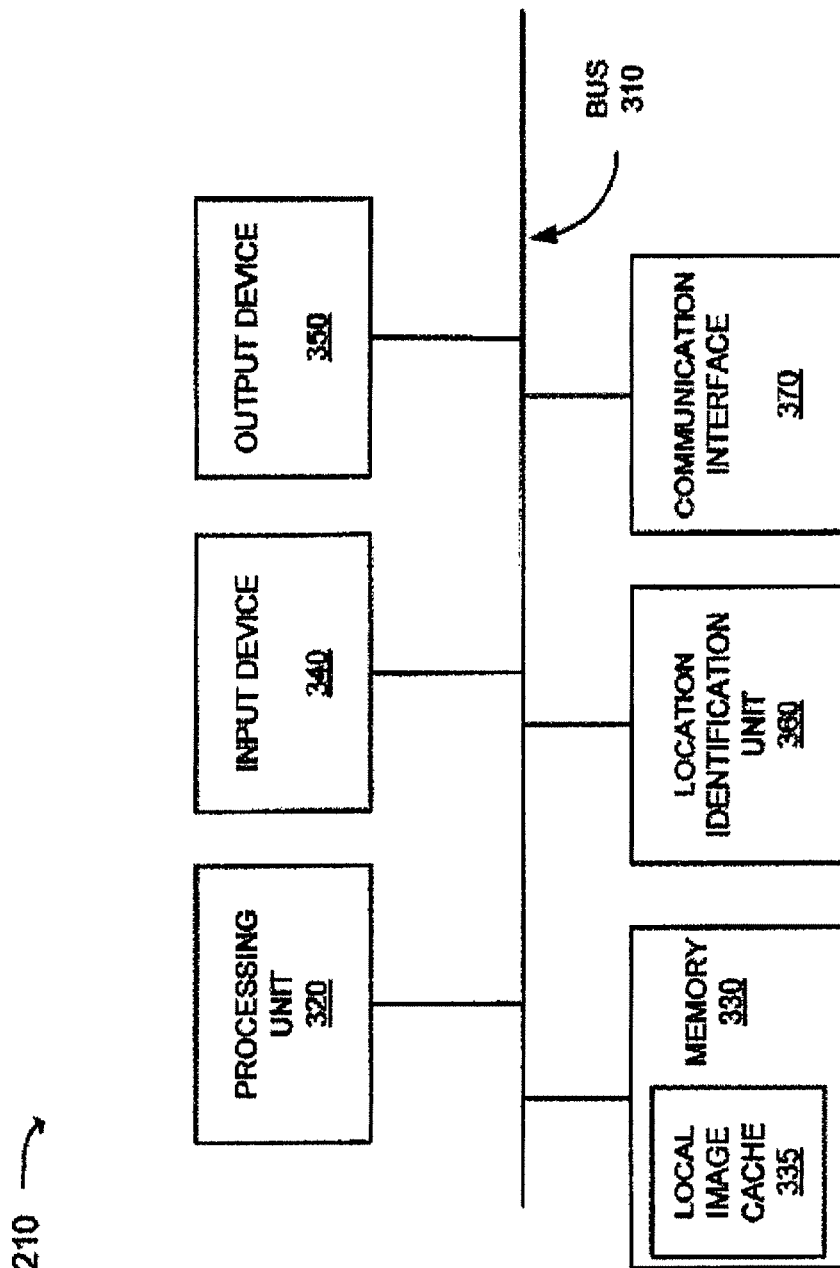


FIG. 3

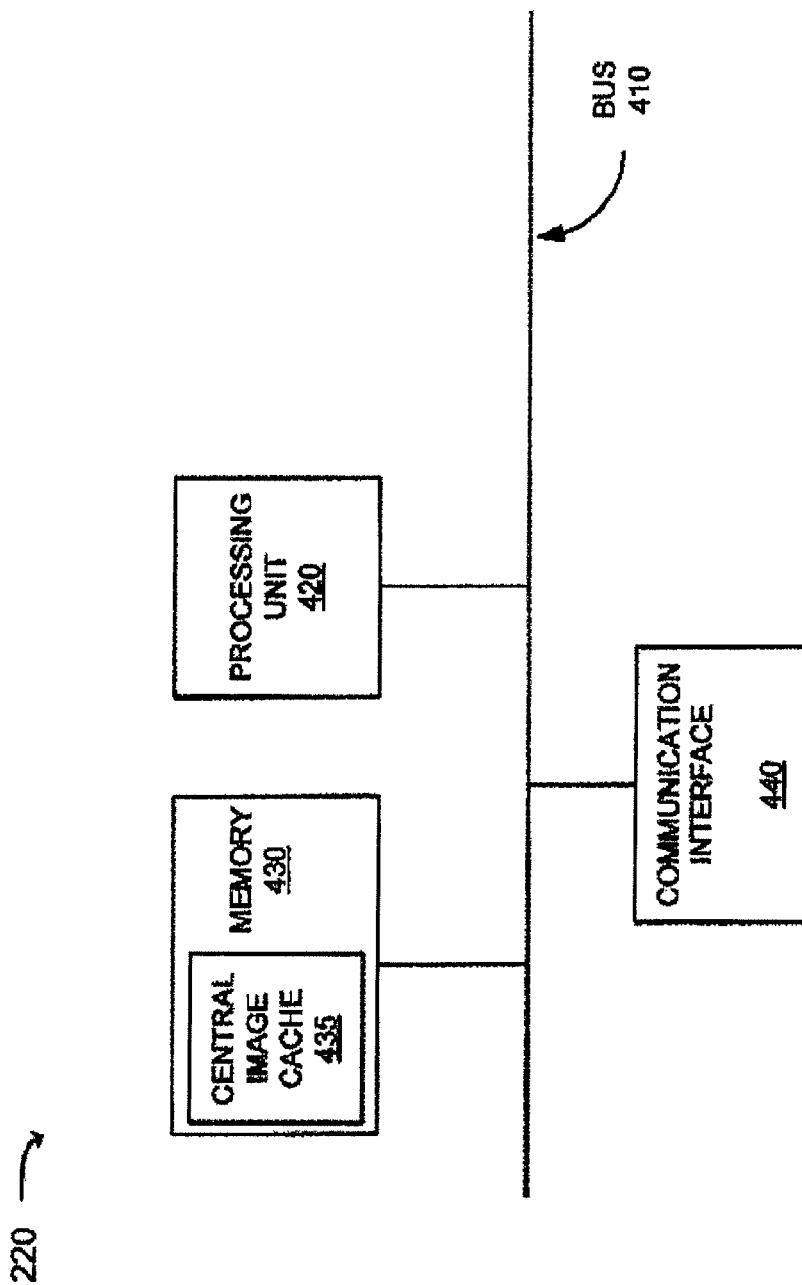


FIG. 4

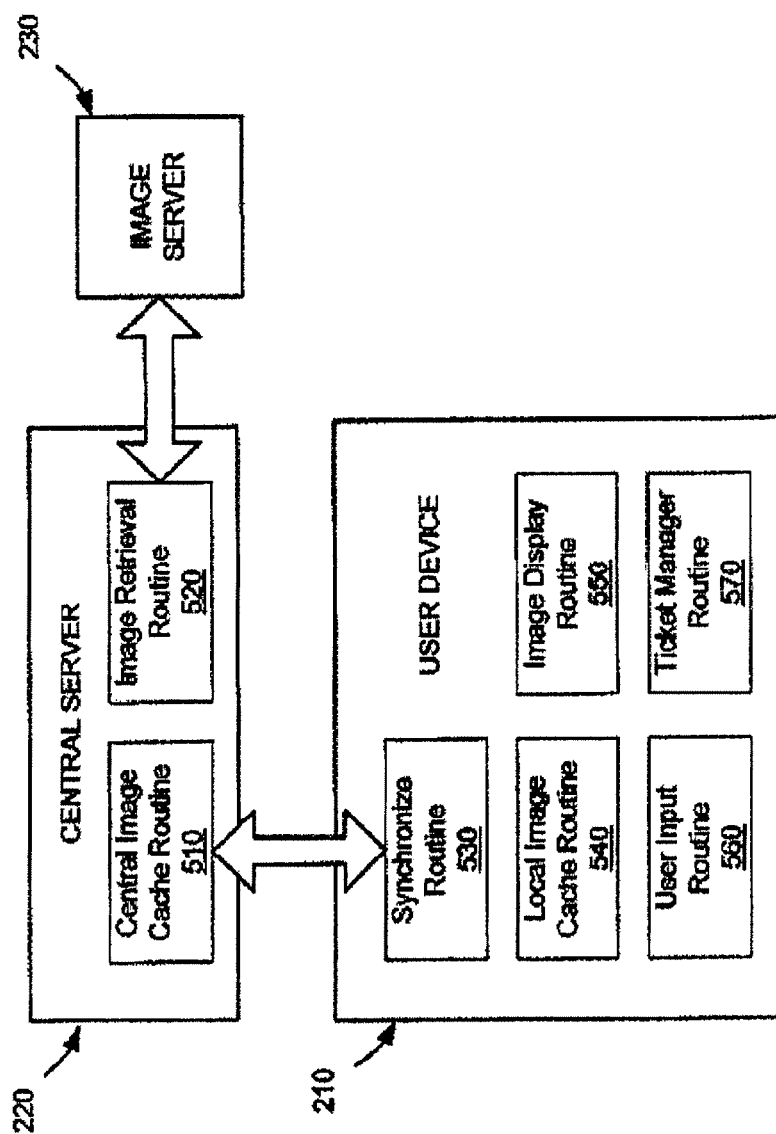
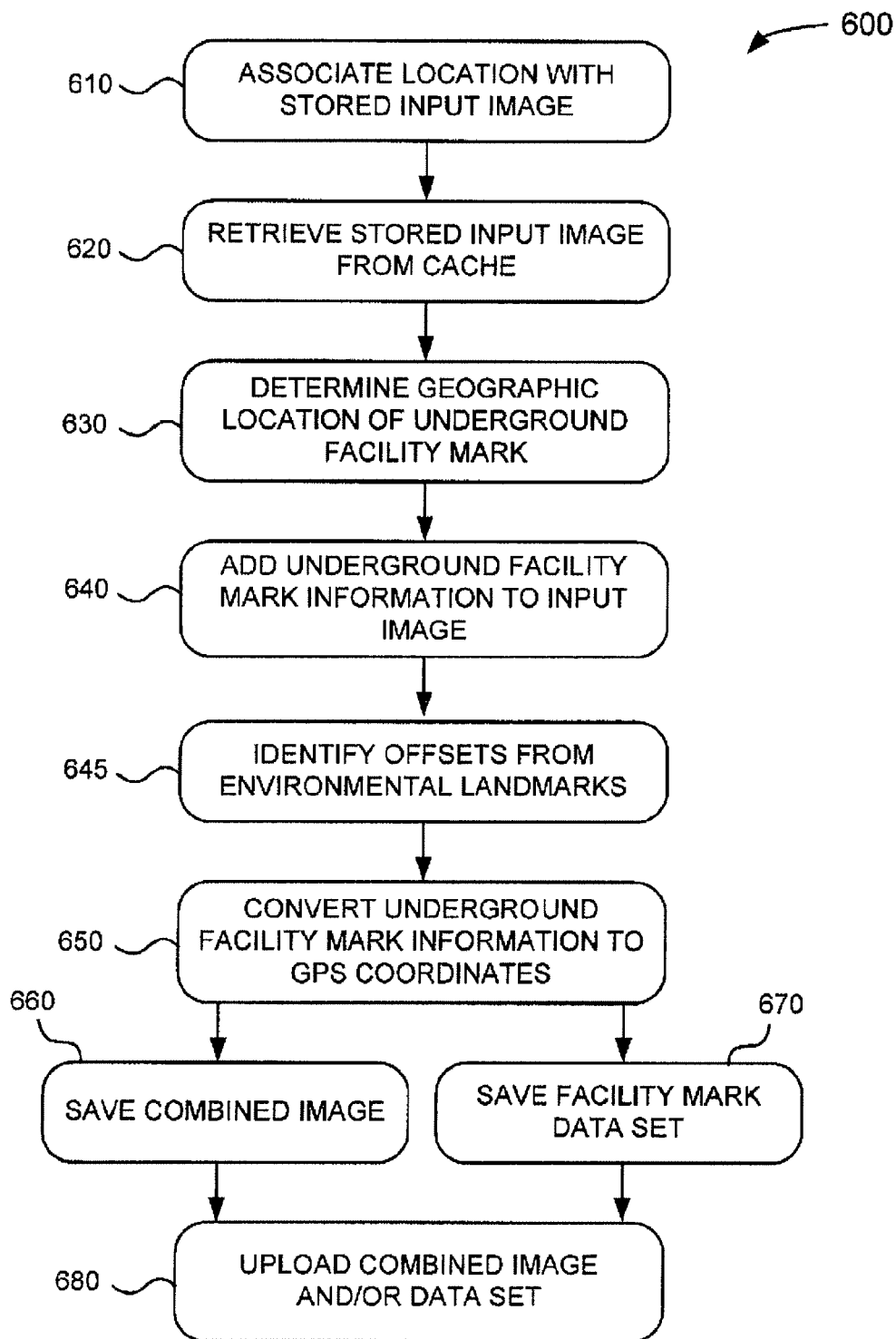


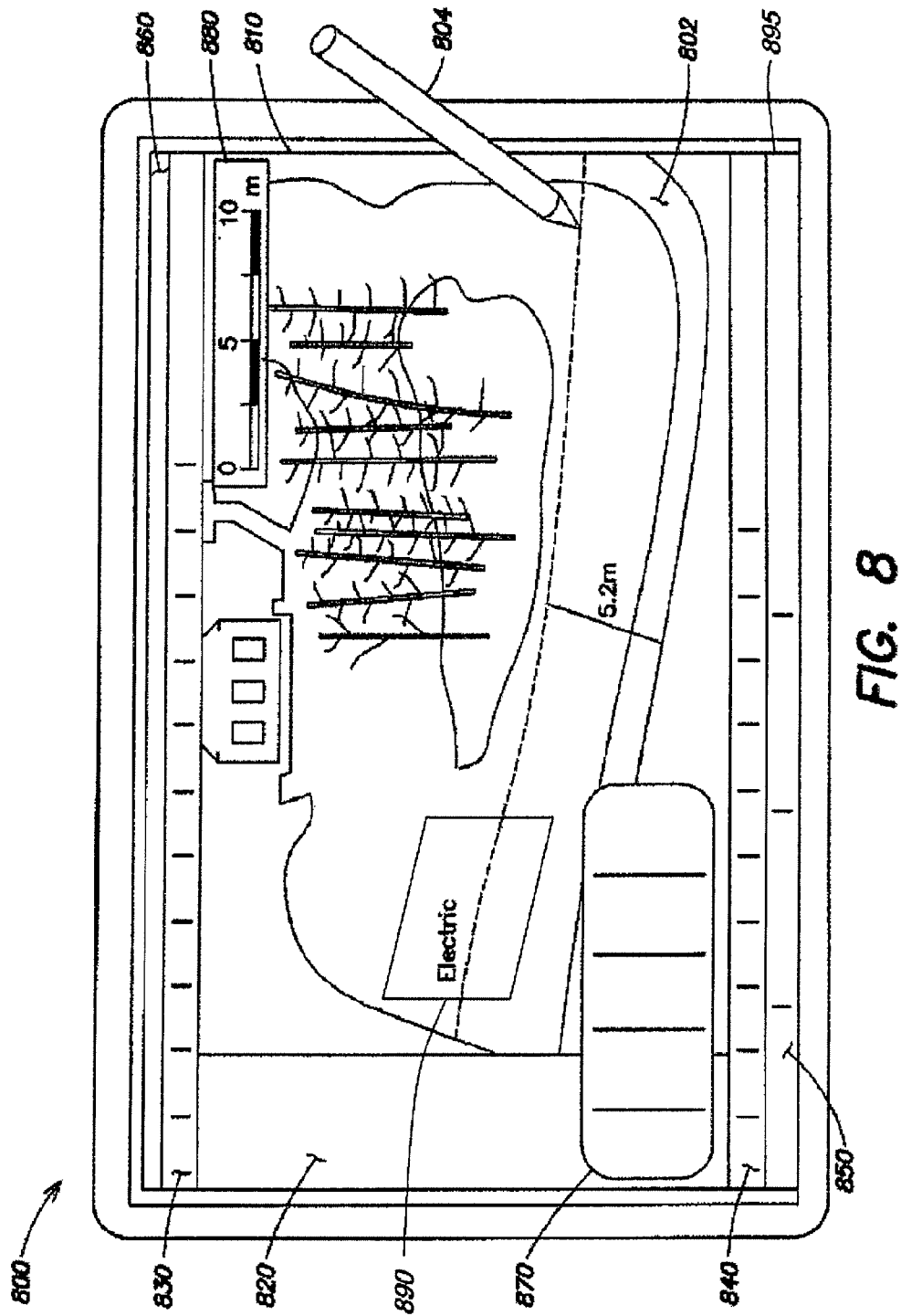
FIG. 5

**FIG. 6**

700 →

ENTRY/ MESSAGE	710 {	TIMESTAMP (2005-10-20 09:43)		FACILITY TYPE IDENTIFIER (POWER)	720		
		FACILITY MARK LOCATION (N38°51.40748, W077°20.27798; . . . ; N38°51.40784, W077°20.27865)			730		
		ENVIRONMENTAL LANDMARK IDENTIFIER (CURB)			740		
		ENVIRONMENTAL LANDMARK LOCATION (N38°51.40756, W077°20.27805; . . . ; N38°51.40773, W077°20.27858)			750		
		OTHER INFORMATION (1.2 METERS BETWEEN CURB AND POWER LINE)			760		
	765 {	FACILITY OWNER/OPERATOR (ABC CORP.)		MARKING METHOD (RED PAINT)	770		
	780 {	PROPERTY ADDRESS (555 MAIN STREET, 22220)		TICKET NUMBER (1234567)	790		
	715 {	LOCATION STAMP (N38°51.40752, W077°20.27840)		CERTIFICATION (Joe Locator)	725		

FIG. 7



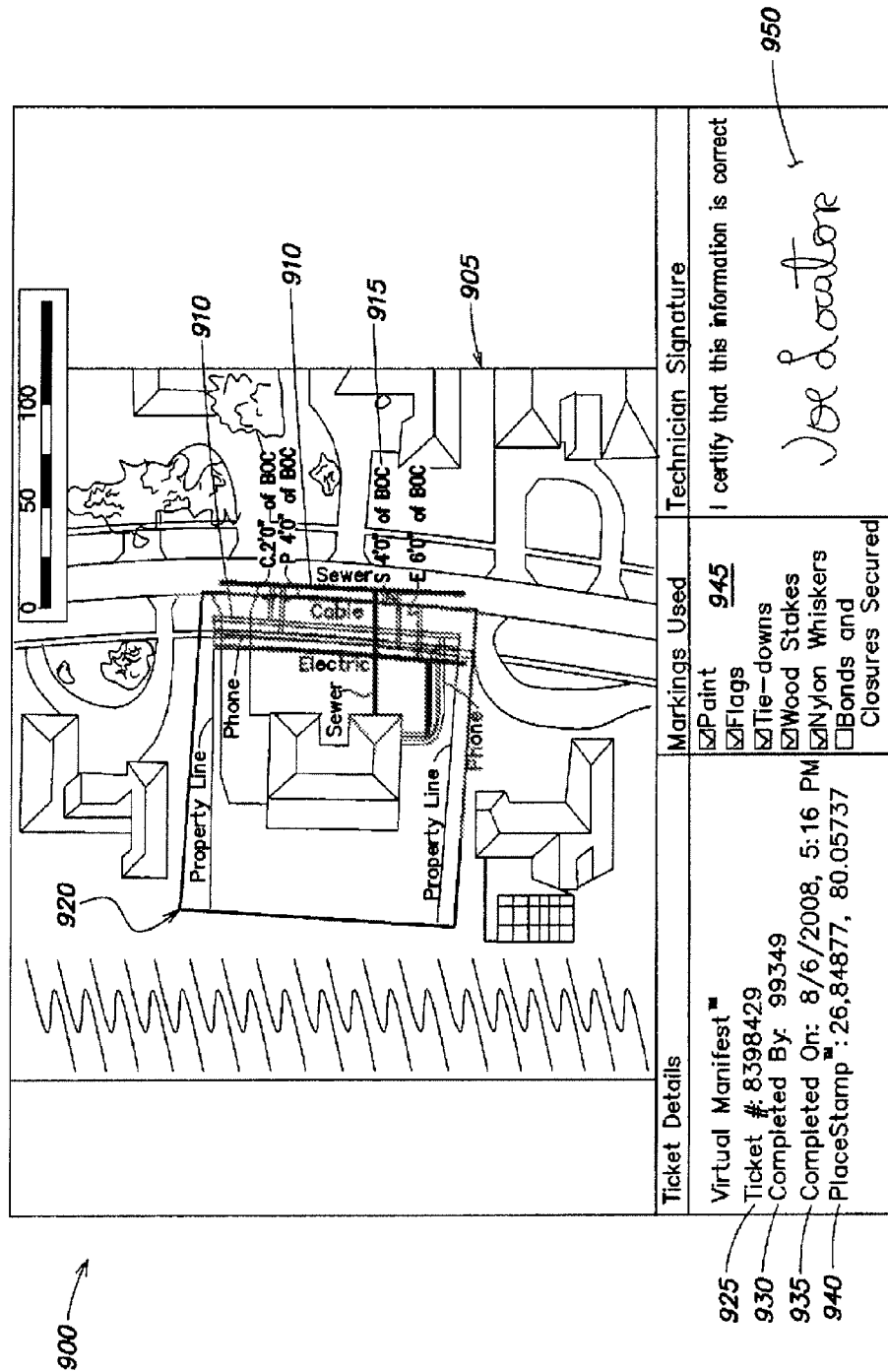


FIG. 9

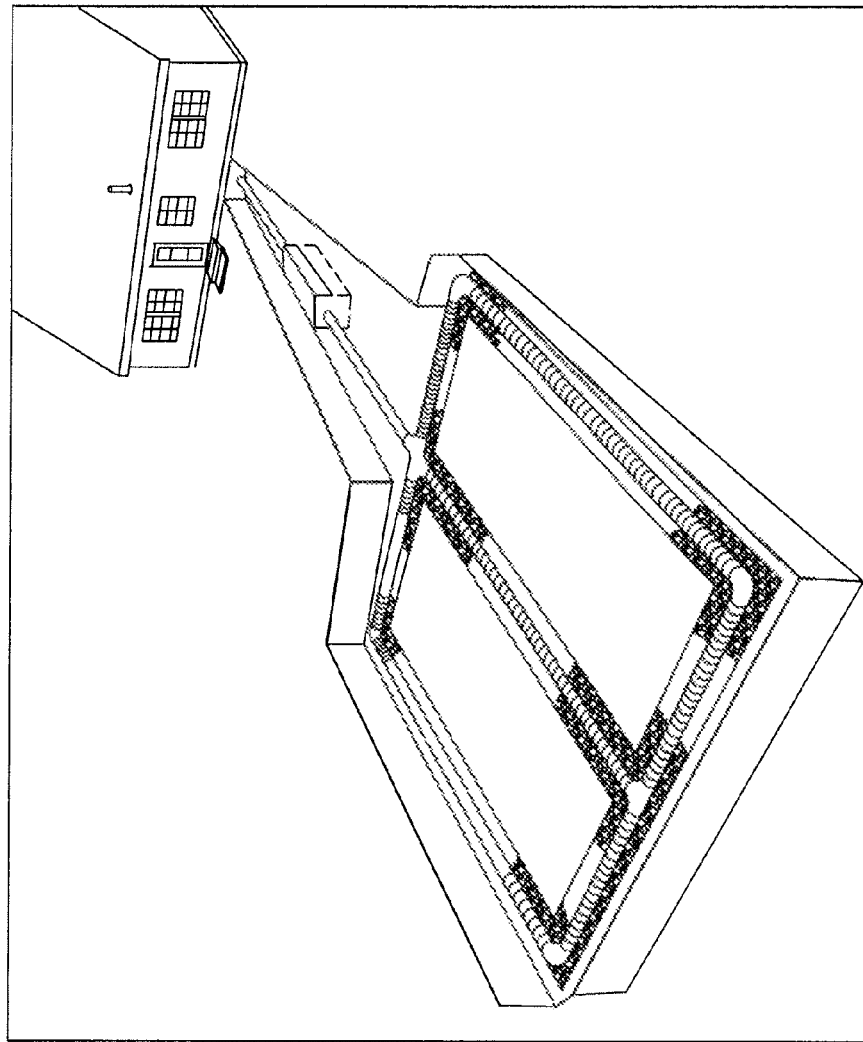


FIG. 10

1000

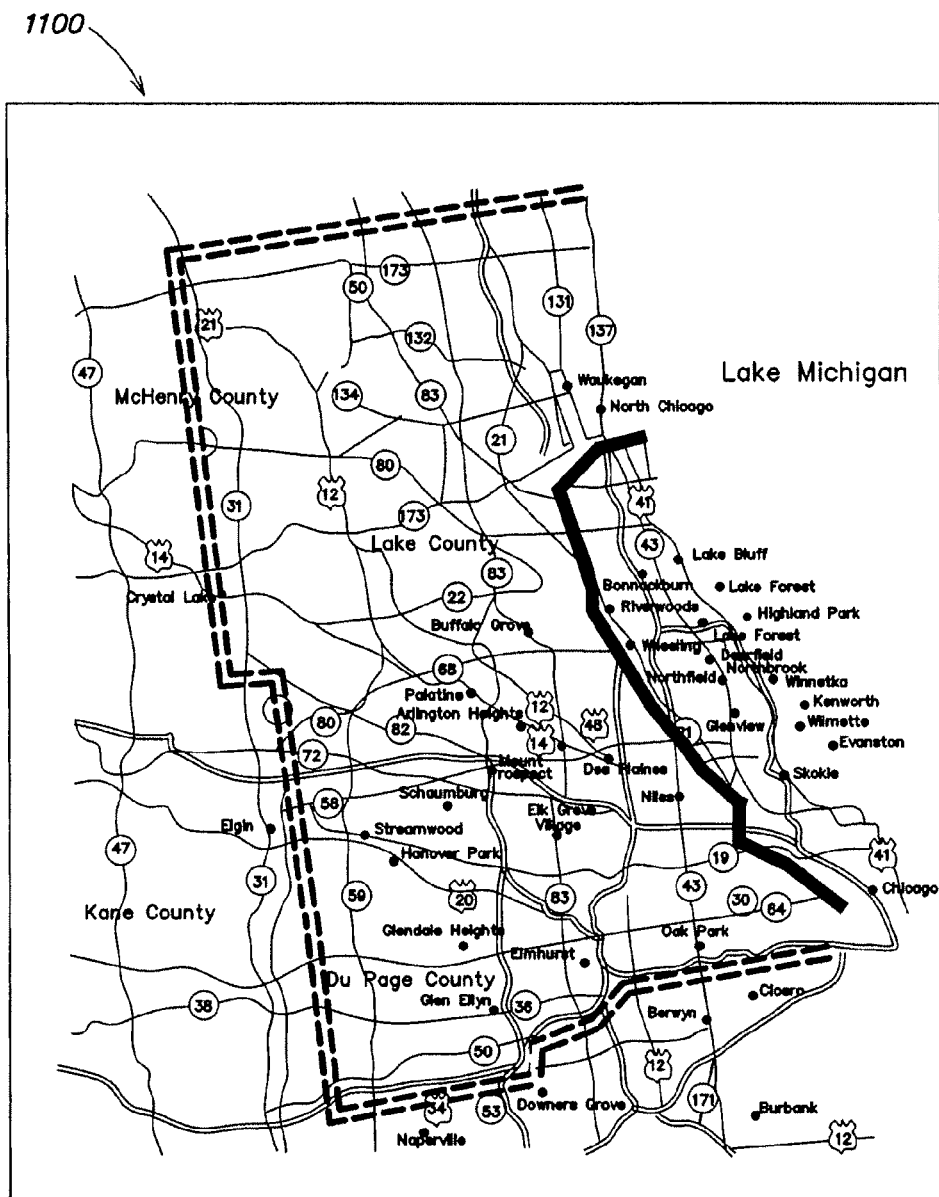


FIG. 11

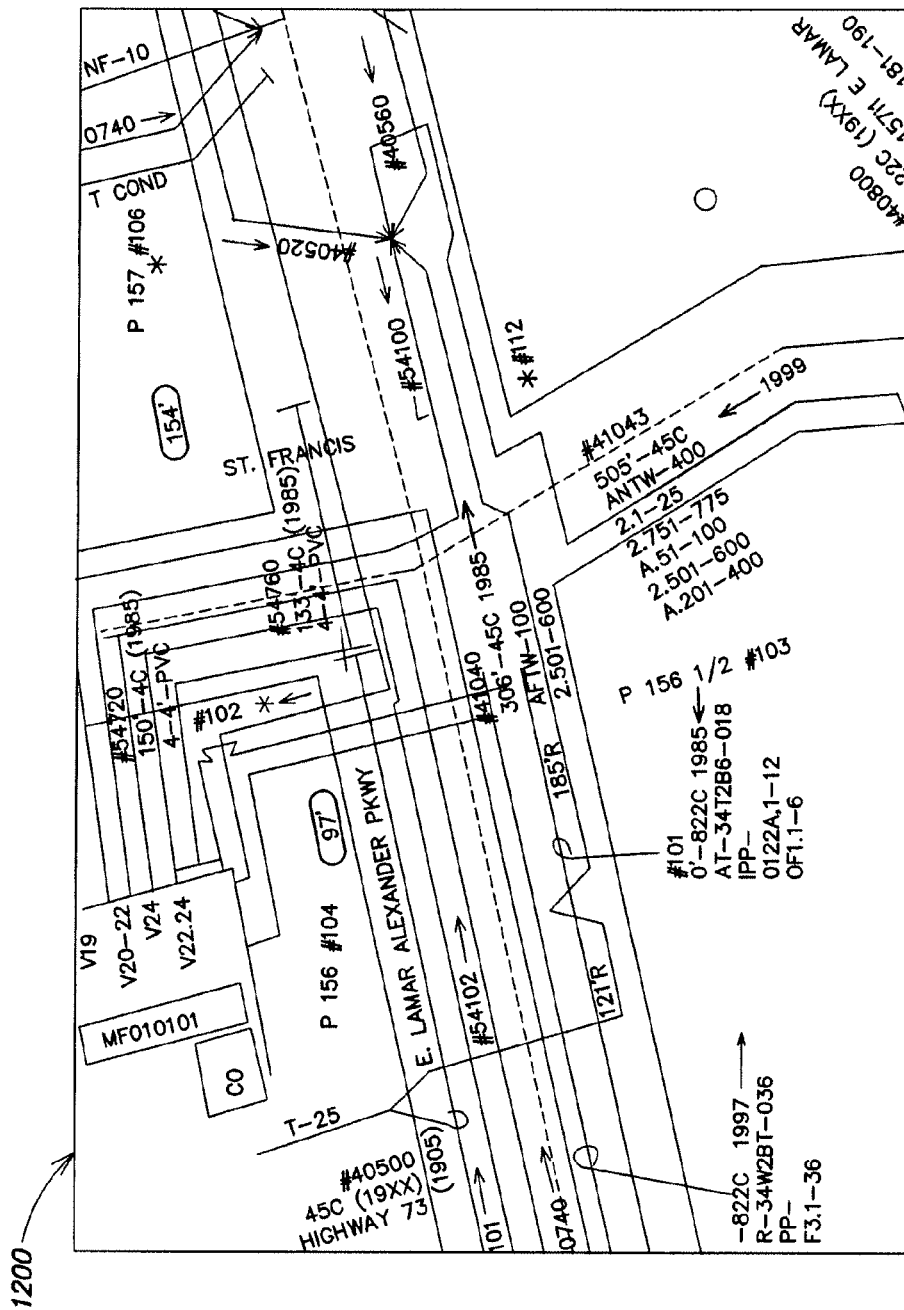


FIG. 12

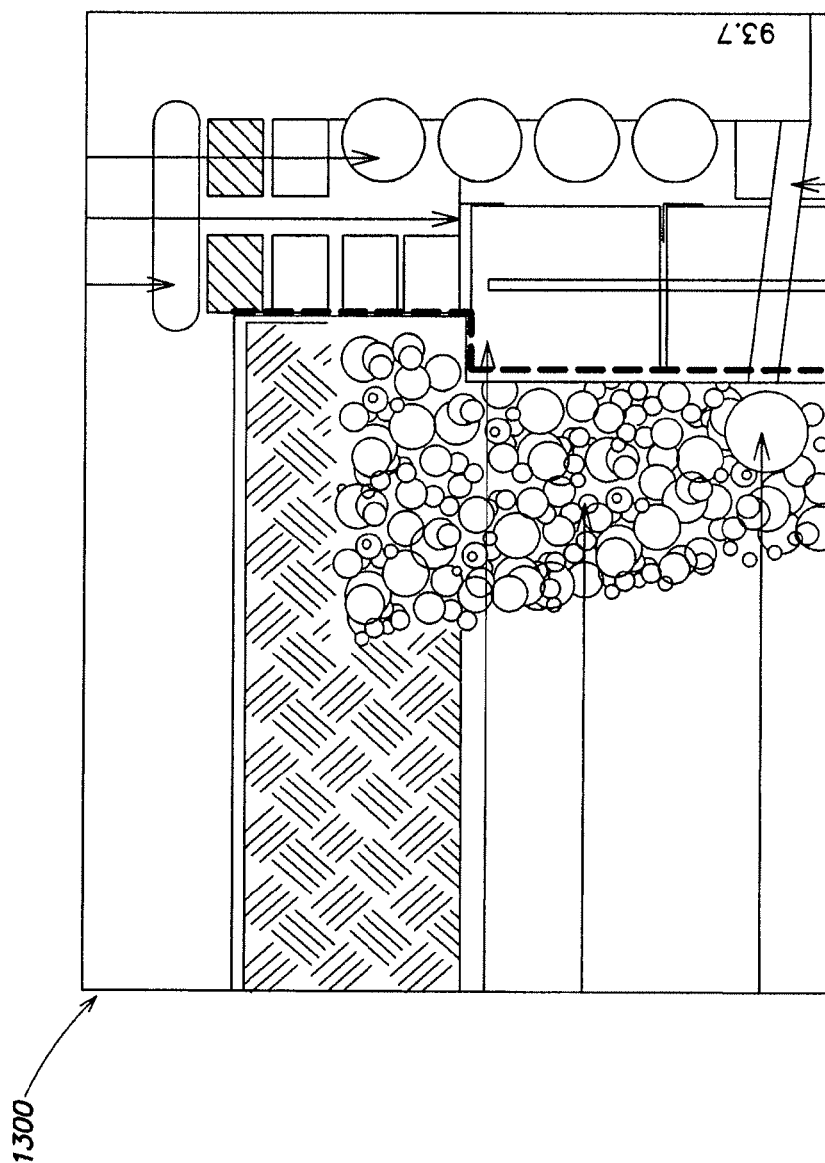


FIG. 13

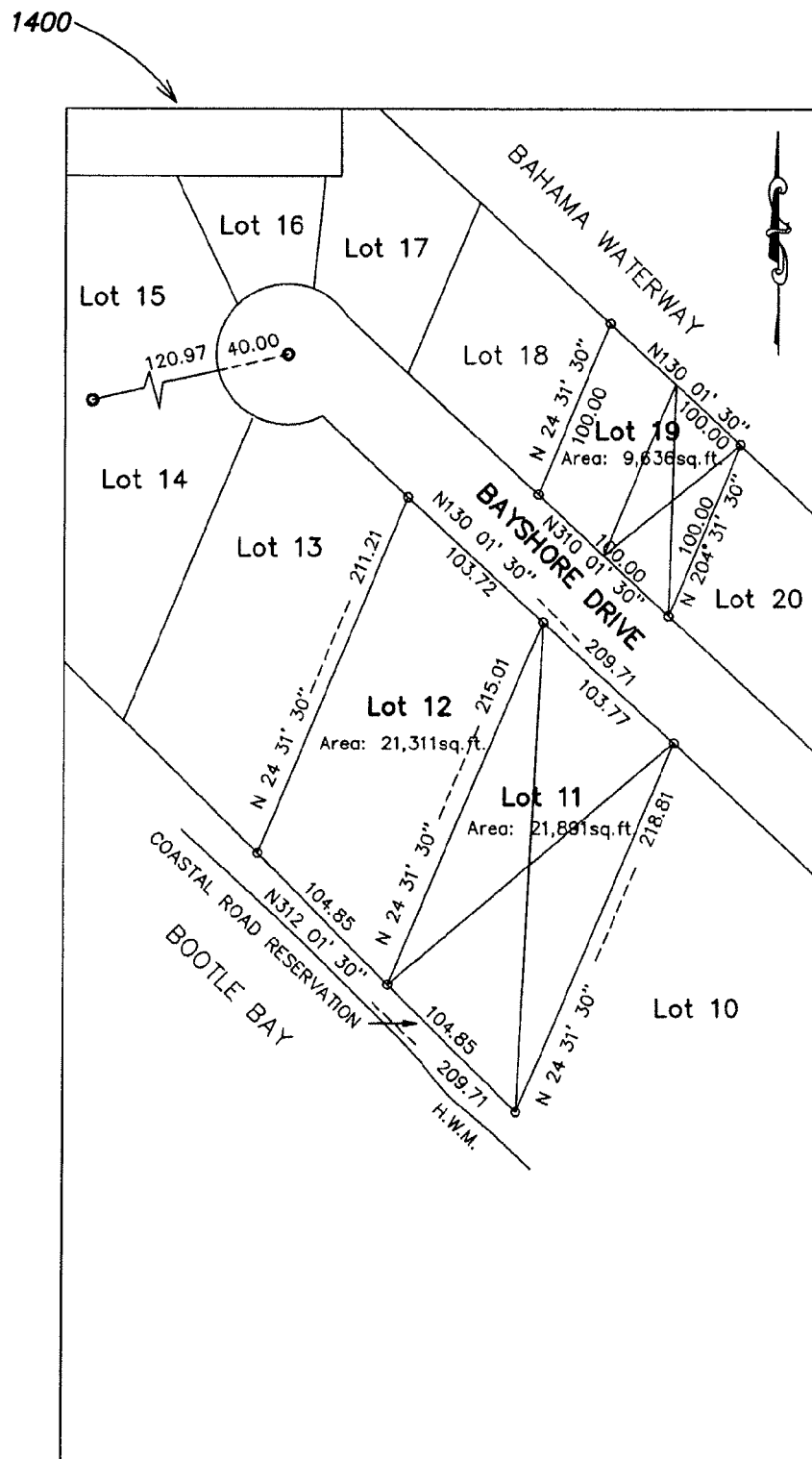


FIG. 14

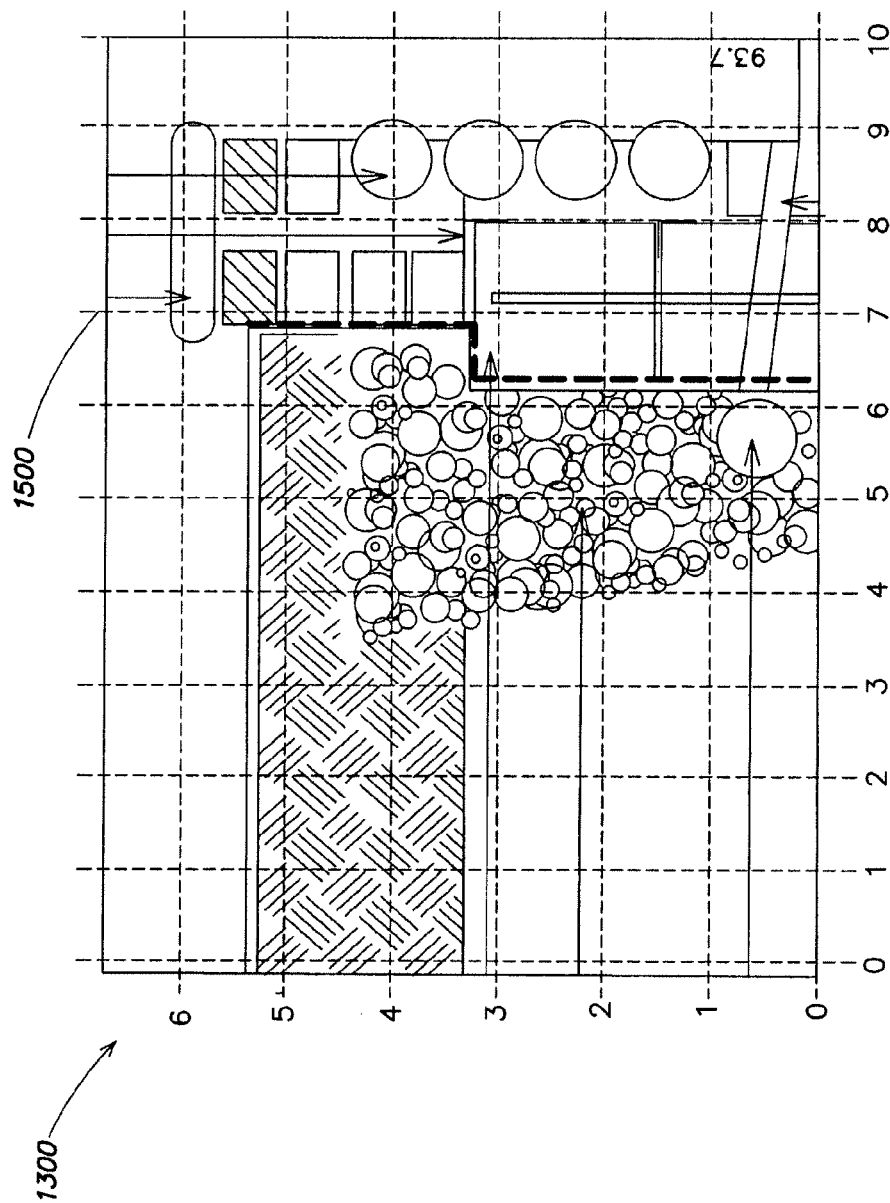


FIG. 15

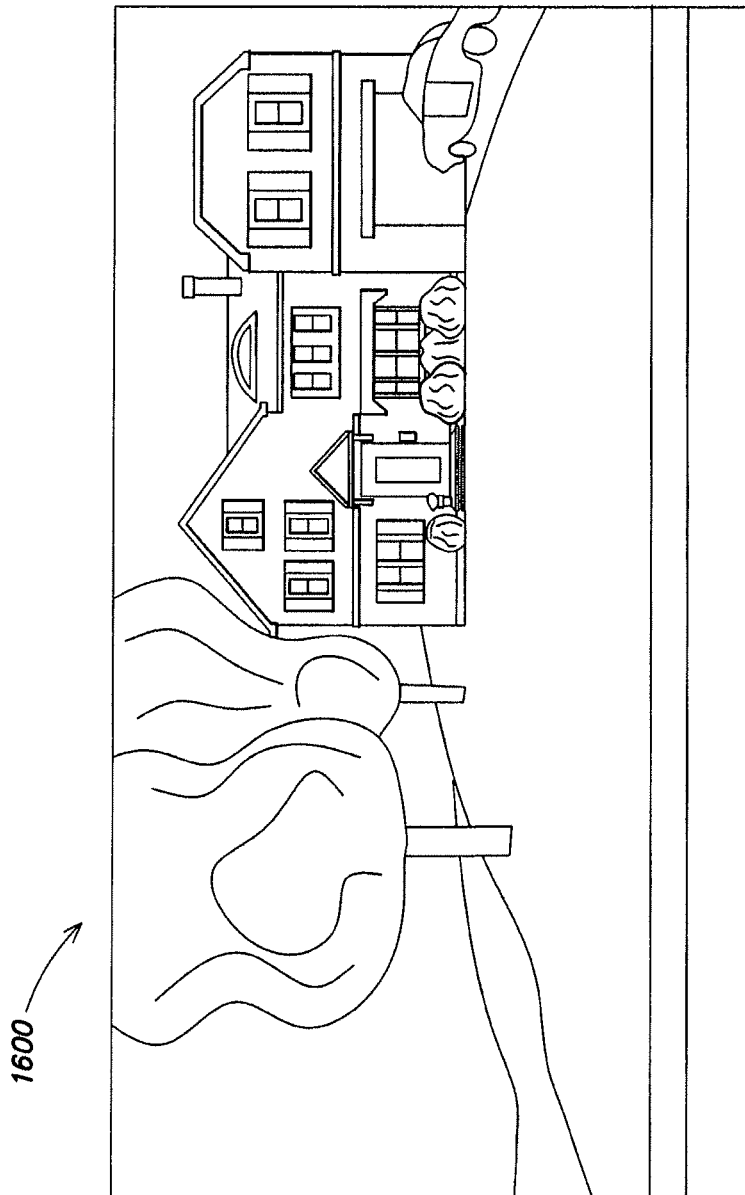


FIG. 16

1

**APPARATUS, SYSTEMS AND METHODS TO
GENERATE ELECTRONIC RECORDS OF
UNDERGROUND FACILITY MARKING
OPERATIONS PERFORMED WITH
GPS-ENABLED MARKING DEVICES**

**CROSS-REFERENCES TO RELATED
APPLICATIONS**

This application claims the benefit, under 35 U.S.C. §120, as a continuation (CON) of U.S. Non-provisional application Ser. No. 13/950,655, filed Jul. 25, 2013, entitled “Electronically Documenting Locate Operations For Underground Utilities,”.

Application Ser. No. 13/950,655 claims the benefit, under 35 U.S.C. §120, as a continuation (CON) of U.S. Non-provisional application Ser. No. 13/796,487, filed Mar. 12, 2013, entitled “Electronically Documenting Locate Operations For Underground Utilities,”.

Application Ser. No. 13/796,487 claims the benefit, under 35 U.S.C. §120, as a continuation (CON) of U.S. Non-provisional application Ser. No. 13/625,436, filed Sep. 24, 2012, entitled “Searchable Records of Underground Facility Locate Marking Operations,”.

Application Ser. No. 13/625,436 claims the benefit, under 35 U.S.C. §120, as a continuation (CON) of U.S. Non-provisional application Ser. No. 12/369,232, filed Feb. 11, 2009, entitled “Searchable Electronic Records of Underground Facility Locate Marking Operations,”.

Application Ser. No. 12/369,232 claims the benefit under 35 U.S.C. §120 as a continuation-in-part of U.S. patent application Ser. No. 12/029,732, filed Feb. 12, 2008, entitled “Electronic Manifest of Underground Facility Locate Marks,”.

Application Ser. No. 12/369,232 also claims the benefit under 35 U.S.C. §120 as a continuation-in-part of U.S. patent application Ser. No. 12/366,853, filed Feb. 6, 2009, entitled “Virtual White Lines for Indicating Planned Excavation Sites on Electronic Images,” which in turn claims the benefit under 35 U.S.C. §120 as a continuation-in-part of U.S. patent application Ser. No. 12/050,555, filed Mar. 18, 2008, entitled “Virtual White Lines for Delimiting Planned Excavation Sites,”.

Each of the above-identified applications is hereby incorporated herein by reference.

BACKGROUND

Excavators are required to notify underground facility owners/operators in advance of their excavation activities and to describe and communicate the geographic area of those activities to underground facility owners/operators. The geographic area so described is commonly referred to as “the dig area.” In turn, facility owners/operators are required to determine if they own or operate any underground facilities at an identified dig area. The presence of underground facilities at a dig area is generally detected using a device commonly referred to as a “locate wand.” Locate wands use a number of electronic methods to detect the presence of underground facilities. The location of those underground facilities, if any, which exist within a dig area, is marked using paint or some other physical marking system, such as flags. Paint is generally applied as a sequence of dashes or dots on the surface (grass, dirt, asphalt, concrete, etc.) directly above the underground facility and is color-coded to indicate to the excavator the type (e.g., gas, water, sewer, power, telephone, cable television, etc.) of the underground facility present. Flags, which also may identify the underground facility via color-

2

coding, can be placed in the ground directly above the underground facility being marked. Paint and/or flags can be dispensed using various devices. The application of paint, flags, or some other marking object to indicate the presence of an underground facility is called a “locate.” The marks resulting from a locate are commonly called underground facility “locate marks.”

Underground facility owners/operators may perform locates with in-house employees or choose to hire independent contract locating firms to perform locates on their behalf. Generally, the person performing the locate operation is called a locate technician. The set of instructions necessary for a locate technician to perform a locate operation may be called a “ticket.” A ticket might specify, for example, the address or description of the dig area to be marked, the day and/or time that the dig area is to be marked, and/or whether the user is to mark the dig area for telecommunications (e.g., telephone and/or cable television), power, gas, water, sewer, or some other underground facility.

It is generally recommended, or in some jurisdictions required, to document the type and number of underground facilities located, i.e. telephone, power, gas, water, sewer, etc., and the approximate geographic location of the locate marks. Often times it is also recommended or required to document the distance, or “offset” of the locate marks from environmental landmarks that exist at the dig area. An environmental landmark may include any physical object that is likely to remain in a fixed location for an extended period of time. Examples of an environmental landmark may include a tree, a curb, a driveway, a utility pole, a fire hydrant, a storm drain, a pedestal, a water meter box, a manhole lid, a building structure (e.g., a residential or office building), or a light post. For example, a telephone cable located two and a half meters behind the curb of a residential street would be documented as being offset two and a half meters behind the curb. These offsets serve as evidence supporting the location of the locate marks after those locate marks may have been disturbed by the excavation process.

Documentation of some or all of the information regarding a locate operation is often called a “manifest.” A manifest may typically contain a variety of information related to a locate operation including a sketch or drawing of the dig area that identifies the approximate location of the locate marks and environmental landmarks present at the dig area; the time and date the locate operation was performed; identification of the entity and the locate technician performing the locate operation; the entity requesting the locate operation; the geographic address of the dig area; the type of markings used for the locate operation (e.g., colored paint, flags, or other markers); notes from the locate technician; and/or a technician signature.

If performing locate operations with in-house employees, each individual underground facility owner/operator generally documents on the manifest only the existence of its facilities and the approximate location of its locate marks. If an independent contract locating firm is hired to perform locates for more than one underground facility owner/operator, the contract locating firm may document on the manifest some or all of the underground facilities at the dig area that it located and the approximate location of all the locate marks.

Currently, locate marks are generally documented using a sketching process which results in the creation of a paper manifest. Sketches are produced by hand, are not to scale, prone to human error, and costly in drafting time spent by the locate technician. They are stored manually or in some jurisdictions are digitally scanned/photographed and the image

3

stored electronically. Because the manifests are stored as paper or digital images, they are not easily interrogated for data in any mechanized way.

SUMMARY

Various embodiments of the present invention are directed to methods, apparatus and systems for creating a searchable electronic record, or “electronic manifest,” relating to a geographic area including a dig area to be excavated or otherwise disturbed. As part of the electronic record, the geographic location of one or more physical locate marks, applied to the dig area during a locate operation to indicate a presence (or absence) of one or more located underground facilities, is somehow identified with respect to its immediate surroundings in the geographic area.

To create such an electronic record, in one exemplary implementation one or more input images relating to the geographic area including the dig area may be utilized. For example, source data representing one or more input images of a geographic area including the dig area is received and/or processed so that the input image(s) may be displayed on a display device. The geographic location of the physical locate mark(s) is then indicated in some manner on the displayed input image(s) so as to generate one or more marked-up images constituting at least a portion of the electronic record. For example, geographic locations of the physical locate mark(s) may be indicated in the marked-up image(s) using digital representation(s) of the physical locate mark(s) (“locate mark indicators”) that are added to the marked-up image(s). In other implementations, the input image need not necessarily be displayed to add one or more locate mark indicators; for example, geographic information relating to one or more physical locate marks applied to the dig area may be received and locate mark indicator(s) may be added to the input image based on the geographic information, without requiring display of the input image.

In some implementations of the inventive concepts disclosed herein, the searchable electronic record may include a variety of non-image information to facilitate identification of the geographic location of the physical locate mark(s) (e.g., a text description of the geographic location of the physical locate mark(s), an address or lot number of a property within which the physical locate mark(s) are located, geo-encoded information such as geographic coordinates relating to the physical locate mark(s) and/or various aspects of the geographic area surrounding the physical locate mark(s), as well as other non-image information relating generally to the locate operation (e.g., a timestamp for the locate operation, geographic information relating to the dig area, one or more identifiers for a locate technician and/or a locate company performing the locate operation, information regarding one or more environmental landmarks, etc.). The marked-up image(s) and the non-image information may be formatted in a variety of manners in the searchable electronic record; for example, in one implementation the non-image information may be included as metadata associated with the marked-up image(s), while in other implementations the marked-up image(s) and the non-image information may be formatted as separate data sets. These separate data sets may be transmitted and/or stored separately. In another aspect, whether transmitted/stored separately or together, the marked-up image(s) and the non-image information may be linked together in some manner as relating to a common electronic record.

In sum, one embodiment of the present invention is directed to a method performed by a device. The method comprises receiving information regarding a particular geo-

4

graphic area; retrieving an aerial image of the particular geographic area; displaying the aerial image; determining an approximate geographic location of a locate mark denoting an underground facility; overlaying, on the displayed aerial image, information concerning the approximate geographic location of the locate mark denoting the underground facility; and storing the aerial image and the information concerning the approximate geographic location of the locate mark denoting the underground facility.

Another embodiment of the present invention is directed to a device, comprising a memory to store aerial images of a plurality of geographic areas; and a processing unit to receive information regarding a particular one of the geographic areas, retrieve one of the aerial images from the memory based on the received information, receive information concerning an approximate geographic location of an underground facility locate mark located within the particular geographic area, present, on the retrieved aerial image, the information concerning the approximate geographic location of the underground facility locate mark, and store the retrieved aerial image and the information concerning the approximate geographic location of the underground facility locate mark.

A further embodiment of the present invention is directed to a system, comprising means for identifying a geographic area; means for retrieving an aerial image of the geographic area; means for displaying the retrieved image; means for receiving input from a user concerning an approximate geographic location of underground facility locate marks that are located within the geographic area; means for presenting, on the displayed aerial image, a marking that identifies the approximate geographic location of the underground facility locate marks within the geographic area; and means for storing the displayed aerial image with the marking that identifies the approximate geographic location of the underground facility locate marks.

Another embodiment of the present invention is directed to a system, comprising a central server to store a plurality of aerial images of a corresponding plurality of geographical locations; and a user device to identify a particular geographic location, determine whether the user device stores an aerial image corresponding to the particular geographic location, retrieve the aerial image from the central server when the user device does not store the aerial image corresponding to the particular geographic location, retrieve the aerial image from a local memory when the user device stores the aerial image corresponding to the particular geographic location, display the aerial image, receive information regarding an approximate location of underground facility locate marks located at the particular geographic location, and present, on the displayed aerial image, a marking that identifies the approximate location of the underground facility locate marks.

A further embodiment of the present invention is directed to a method performed by a device. The method comprises receiving information regarding a particular geographic area; retrieving an aerial image of the particular geographic area; receiving, from a global positioning system (GPS)-enabled device, information regarding an approximate location of underground facility locate marks; displaying, as a combined image, the aerial image and the information regarding the approximate location of underground facility locate marks; and storing the combined image.

Another embodiment of the present invention is directed to a device, comprising a memory to store images of a plurality of geographic locations; a processing unit to retrieve one of the images from the memory based on received information, the received information concerning a geographic location of

5

an underground facility locate mark located within a particular dig area; present, on the retrieved image, the received information of the underground facility locate mark; and store the retrieved image and the received information of the geographic location of the underground facility locate mark.

A further embodiment of the present invention is directed to a system, comprising means for identifying a geographic location; means for retrieving an image of the geographic location; means for displaying the retrieved image; means for receiving input from a user concerning a geographic location of underground facility locate marks that are located within the dig area; means for presenting, on the displayed image, a marking that identifies the geographic location of the underground facility locate marks within the dig area; and means for storing the displayed image with the marking that identifies the geographic location of the underground facility locate marks.

Another embodiment of the present invention is directed to a system, comprising a central server to store a plurality of images of a plurality of geographical locations; a user device to identify at least one of the geographic locations, and to retrieve the image from the central server when the user device does not store the image corresponding to at least one of the geographic locations, or to retrieve the image from a local memory when the user device stores the image corresponding to the at least one of the geographic locations; display the image; receive information regarding an approximate location of underground facility locate marks located at the at least one geographic location; and present, on the displayed image, a marking that identifies the approximate location of the underground facility locate marks.

A further embodiment of the present invention is directed to a method for generating a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically receiving a digital image of a geographic area comprising the dig area, at least a portion of the received digital image being displayed on a display device; B) adding to the displayed digital image at least one digital representation of the at least one physical locate mark applied by the locate technician during the locate operation so as to generate a marked-up digital image including the at least one digital representation of the at least one physical locate mark; and C) electronically transmitting and/or electronically storing information relating to the marked-up digital image so as to generate the searchable electronic record of the locate operation.

Another embodiment of the present invention is directed to a computer-readable medium encoded with instructions that, when executed on at least one processing unit, perform a method of generating a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities, the method comprising A) electronically receiving a digital image of a geographic area comprising the dig area; B) receiving user input regarding a geographic location of the at least one physical locate mark applied by the locate technician during the locate operation; and C) rendering a screen display comprising at least a portion of the received digital image and at least one digital representation of the at least one physical locate mark, wherein the at least one digital repre-

6

sentation is positioned with respect to the at least a portion of the received digital image based at least in part on the user input received in B).

A further embodiment of the present invention is directed to an apparatus for facilitating generation of a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprising identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The apparatus comprises a communication interface; a display device; a user input device; a memory to store processor-executable instructions; and a processing unit coupled to the communication interface, the display device, the user input device, and the memory, wherein upon execution of the processor-executable instructions by the processing unit. The processing unit controls the communication interface to electronically receive a digital image of a geographic area including the dig area; controls the display device to display at least a portion of the received digital image; acquires user input from the user input device, the user input relating to a geographic location of the at least one physical locate mark applied by the locate technician during the locate operation; generates a marked-up digital image including at least one digital representation of the at least one physical locate mark based at least in part on the user input; and further controls the communication interface and/or the memory to electronically transmit and/or electronically store information relating to the marked-up digital image so as to generate the searchable electronic record of the locate operation.

Another embodiment of the present invention is directed to a method for generating a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically receiving a digital image of a geographic area comprising the dig area, at least a portion of the received digital image being displayed on a display device; B) electronically receiving location information regarding an identified location of the at least one physical locate mark; C) based at least in part on the location information received in B), digitally representing, on the displayed digital image, the identified location of the at least one physical locate mark applied by the locate technician during the locate operation so as to generate a marked-up digital image including the at least one digital representation of the at least one physical locate mark; and D) electronically transmitting and/or electronically storing information relating to the marked-up digital image so as to generate the searchable electronic record of the locate operation.

A further embodiment of the present invention is directed to a computer-readable medium encoded with instructions that, when executed on at least one processing unit, perform a method of generating a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically receiving a digital image of a geographic area comprising the dig area; B) electronically receiving, from a GPS-enabled device, information regarding a GPS-determined geographic location of the at least one physical locate mark applied by the locate

technician during the locate operation; C) rendering a screen display comprising at least a portion of the received digital image and at least one digital representation of the at least one physical locate mark, wherein the at least one digital representation is positioned with respect to the at least a portion of the received digital image based on the GPS-determined geographic location of the at least one physical locate mark; and D) electronically transmitting and/or electronically storing information identifying the GPS-determined geographic location of the at least one physical locate mark so as to document the at least one physical locate mark applied by the locate technician.

Another embodiment of the present invention is directed to an apparatus for facilitating generation of a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The apparatus comprises a communication interface; a display device; a memory to store processor-executable instructions; and a processing unit coupled to the communication interface, the display device, and the memory, wherein upon execution of the processor-executable instructions by the processing unit. The processing unit controls the communication interface to electronically receive a digital image of a geographic area including the dig area; controls the display device to display at least a portion of the received digital image; acquires input from a marking device configured to apply the at least one physical locate mark to the dig area, the input relating to a geographic location of the at least one physical locate mark applied by the locate technician during the locate operation; generates a marked-up digital image including at least one digital representation of the at least one physical locate mark, based at least in part on the input acquired from the marking device; and further controls the communication interface and/or the memory to electronically transmit and/or electronically store information relating to the marked-up digital image so as to generate the searchable electronic record of the locate operation.

A further embodiment of the present invention is directed to an apparatus for facilitating generation of a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The apparatus comprises a communication interface; a display device; a memory to store processor-executable instructions; and a processing unit coupled to the communication interface, the display device, and the memory. Upon execution of the processor-executable instructions by the processing unit, the processing unit controls the communication interface to electronically receive an image of a geographic area including the dig area; controls the display device to display at least a portion of the received image; combines the electronically received image with image-related information so as to generate the searchable electronic record, and controls the communication interface and/or the memory to electronically transmit and/or electronically store the searchable electronic record of the locate operation so that performance of the location operation is verifiable. The image-related information comprises a geographic location associated with the dig area; and a timestamp indicative of when the locate operation occurred.

Another embodiment of the present invention is directed to a method for generating a searchable electronic record of a locate operation performed by a locate technician. The locate

operation comprises identifying a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically receiving an image of a geographic area comprising the dig area; B) combining the electronically received image with image-related information so as to generate the searchable electronic record; and C) electronically transmitting and/or electronically storing the searchable electronic record of the locate operation so that performance of the location operation is verifiable. The image-related information comprises a geographic location associated with the dig area; and a timestamp indicative of when the locate operation occurred.

A further embodiment of the present invention is directed to a computer-readable medium encoded with instructions that, when executed on at least one processing unit, perform a method of generating a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying a presence or an absence of at least one underground facility within a dig area, wherein at least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically receiving an image of a geographic area comprising the dig area; B) combining the electronically received image with image-related information so as to generate the searchable electronic record; and C) electronically transmitting and/or electronically storing the searchable electronic record of the locate operation so that performance of the location operation is verifiable. The image-related information comprises a geographic location associated with the dig area; and a timestamp indicative of when the locate operation occurred.

Another embodiment of the present invention is directed to a method for generating a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically receiving source data representing at least one input image of a geographic area comprising the dig area; B) processing the source data so as to display at least a portion of the at least one input image on a display device; C) adding to the displayed at least one input image at least one digital representation of the at least one physical locate mark applied by the locate technician during the locate operation so as to generate a marked-up image including the at least one digital representation of the at least one physical locate mark; and D) electronically transmitting and/or electronically storing information relating to the marked-up image so as to generate the searchable electronic record of the locate operation.

A further embodiment of the present invention is directed to at least one computer-readable medium encoded with instructions that, when executed on at least one processing unit, perform a method for generating a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically receiving source data representing at least one input image of a geographic area comprising the dig area; B) processing the source data so as to display at least a portion of the at least one input image on a display device; C) adding to the displayed at least one input image at least one digital representation of the at least one physical locate mark applied by the locate technician.

nician during the locate operation so as to generate a marked-up image including the at least one digital representation of the at least one physical locate mark; and D) electronically transmitting and/or electronically storing information relating to the marked-up image so as to generate the searchable electronic record of the locate operation.

Another embodiment of the present invention is directed to an apparatus for facilitating generation of a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The apparatus comprises a communication interface; a display device; a memory to store processor-executable instructions; and a processing unit coupled to the communication interface, the display device, and the memory, wherein upon execution of the processor-executable instructions by the processing unit. The processing unit controls the communication interface to electronically receive source data representing at least one input image of a geographic area including the dig area; processes the source data and controls the display device so as to display at least a portion of the at least one input image; adds to the displayed at least one input image at least one digital representation of the at least one physical locate mark applied by the locate technician during the locate operation so as to generate a marked-up image including the at least one digital representation of the at least one physical locate mark; and further controls the communication interface and/or the memory to electronically transmit and/or electronically store information relating to the marked-up image so as to generate the searchable electronic record of the locate operation.

A further embodiment of the present invention is directed to a method for generating a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically receiving source data representing at least one input image of a geographic area comprising the dig area, the at least one input image including at least one dig area indicator to provide at least one indication of the dig area in the displayed at least one input image; B) processing the source data so as to display at least a portion of the at least one input image including the at least one dig area indicator on a display device; C) adding to the displayed at least one input image at least one locate mark indicator to provide a digital representation of the at least one physical locate mark applied by the locate technician during the locate operation, thereby generating a marked-up image including the at least one dig area indicator and the at least one locate mark indicator; and D) electronically transmitting and/or electronically storing information relating to the marked-up image so as to generate the searchable electronic record of the locate operation.

Another embodiment of the present invention is directed at least one computer-readable medium encoded with instructions that, when executed on at least one processing unit, perform a method of generating a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically receiving

source data representing at least one input image of a geographic area comprising the dig area, the at least one input image including at least one dig area indicator to provide at least one indication of the dig area in the displayed at least one input image; B) processing the source data so as to display at least a portion of the at least one input image including the at least one dig area indicator on a display device; C) adding to the displayed at least one input image at least one locate mark indicator to provide a digital representation of the at least one physical locate mark applied by the locate technician during the locate operation, thereby generating a marked-up image including the at least one dig area indicator and the at least one locate mark indicator; and D) electronically transmitting and/or electronically storing information relating to the marked-up image so as to generate the searchable electronic record of the locate operation.

A further embodiment of the present invention is directed to an apparatus for facilitating generation of a searchable electronic record of a locate operation performed by a locate technician. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The apparatus comprises a communication interface; a display device; a memory to store processor-executable instructions; and a processing unit coupled to the communication interface, the display device, and the memory. Upon execution of the processor-executable instructions by the processing unit, the processing unit controls the communication interface to electronically receive source data representing at least one input image of a geographic area comprising the dig area, the at least one input image including at least one dig area indicator to provide at least one indication of the dig area in the displayed at least one input image; processes the source data and controls the display device so as to display at least a portion of the at least one input image including the at least one dig area indicator on the display device; adds to the displayed at least one input image at least one locate mark indicator to provide a digital representation of the at least one physical locate mark applied by the locate technician during the locate operation, thereby generating a marked-up image including the at least one dig area indicator and the at least one locate mark indicator; and further controls the communication interface and/or the memory to electronically transmit and/or electronically store information relating to the marked-up image so as to generate the searchable electronic record of the locate operation.

Another embodiment of the present invention is directed to a method for certifying a locate operation. The locate operation comprises identifying, using at least one physical locate mark, a presence or an absence of at least one underground facility within a dig area. At least a portion of the dig area may be excavated or disturbed during excavation activities. The method comprises A) electronically recalling, via a display device coupled to a central server, a searchable electronic record of a locate operation performed by a locate technician, the searchable electronic record stored in memory associated with the central server. The searchable electronic record comprises (i) a marked-up digital image comprising a digital image of a geographic area comprising the dig area, and at least one digital representation, marked on the digital image of the geographic area, of the at least one physical locate mark, and (ii) a data set associated with the marked-up digital image, the data set including information relating to the locate operation. The method further comprises B) verifying, based at least in part on the electronically recalled searchable electronic record, whether the at least one digital representation of

11

the at least one physical locate mark in the marked-up digital image accurately reflects the presence or the absence of the at least one underground facility within the dig area; C) altering the searchable electronic record, via a user interface device associated with the display device, to indicate completion of B); and D) electronically transmitting and/or electronically storing the altered searchable electronic record so as to facilitate the excavation activities and/or an investigation thereof.

It should be appreciated that all combinations of the foregoing concepts and additional concepts discussed in greater detail below (provided such concepts are not mutually inconsistent) are contemplated as being part of the inventive subject matter disclosed herein. In particular, all combinations of claimed subject matter appearing at the end of this disclosure are contemplated as being part of the inventive subject matter disclosed herein. It should also be appreciated that terminology explicitly employed herein that also may appear in any disclosure incorporated by reference should be accorded a meaning most consistent with the particular concepts disclosed herein.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate one or more embodiments described herein and, together with the description, explain these embodiments. In the drawings:

FIG. 1 is a diagram of an exemplary searchable electronic record of a locate operation, according to one embodiment of the present invention;

FIG. 2 is a diagram of an exemplary network in which the various inventive concepts described herein may be implemented, according to one embodiment of the present invention;

FIG. 3 is a diagram of exemplary components of the user device of FIG. 2;

FIG. 4 is a diagram of exemplary components of the central server of FIG. 2;

FIG. 5 is a diagram of exemplary software routines for components of FIG. 2;

FIG. 6 is a flowchart of an exemplary process for creating an electronic manifest of underground facility locate marks, according to one embodiment of the present invention;

FIG. 7 is a diagram of an exemplary data set that may be stored in the memory of FIG. 3 and/or FIG. 4, according to one embodiment of the present invention;

FIG. 8 is a diagram of an exemplary user interface that may be presented via the user device of FIG. 2, according to one embodiment of the present invention;

FIG. 9 is a diagram illustrating various elements of a searchable electronic record of a locate operation according to one embodiment of the present invention;

FIG. 10 shows a sketch 1000, representing an exemplary input image;

FIG. 11 shows a map 1100, representing an exemplary input image;

FIG. 12 shows a facility map 1200, representing an exemplary input image;

FIG. 13 shows a construction/engineering drawing 1300, representing an exemplary input image;

FIG. 14 shows a land survey map 1400, representing an exemplary input image;

FIG. 15 shows a grid 1500, overlaid on the construction/engineering drawing 1300 of FIG. 14, representing an exemplary input image; and

12

FIG. 16 shows a street level image 1600, representing an exemplary input image.

DETAILED DESCRIPTION

The following detailed description refers to the accompanying drawings. The same reference numbers in different drawings may identify the same or similar elements. Also, the following detailed description does not limit the invention.

Overview

FIG. 1 is a diagram illustrating an exemplary searchable electronic record, or “electronic manifest,” of a locate operation, according to one embodiment of the present invention. When locating underground facilities at a geographic location, such as at a dig area 100 associated with a residence or a business, it may be beneficial to document locate marks in a permanent and reproducible manner. For example, a locate technician may locate and mark underground facilities using a locating device and/or a marking device. A locating device may generally be defined as a locating wand or another device used to detect the presence of underground facilities, while a marking device may generally be defined as any tool (e.g., a paint wand) to apply a physical locate mark, such as paint or other material to a surface. The locate technician may use paint, flags, or some other object with a particular color or other characteristic to mark the location of an underground facility. Referring to the example shown in FIG. 1, the locate technician may use red paint to mark underground power lines 110, orange paint to mark telecommunications (e.g., telephone and/or cable television) lines 120, and yellow paint to mark gas lines 130.

The locate technician may also identify one or more environmental landmarks that are present at or near the dig area and/or determine the distance between the environmental landmark(s) and the located underground facility. For example, a transformer 140 may be indicated as an environmental landmark, as shown in FIG. 1. The geographic location of transformer 140 may be used to measure offsets to other locate marks in the dig area.

As described herein, documentation of some or all of this information regarding a locate operation is created as a searchable electronic record, also referred to herein as “an electronic manifest.” An electronic manifest, as used herein, may generally refer to one or more computer-readable files that include some or all of the information in a manifest. The electronic manifest may be created using one or more input images of a dig area, such as dig area 100, that may be combined with other information (e.g., non-image information) that is added by the user (e.g., a locate technician) about the locate operation. In other implementations, an electronic manifest may be created using one or more input images of a dig area combined with information about locate marks that is provided by other sources. Other implementations may use one or more input images of a dig area combined with information that is added by the user and information that is provided by other sources. As used herein, a “user” may refer to any person operating a device to create an electronic manifest, such as a locate technician, a site supervisor, or any other person or group of people.

Accordingly, various embodiments of the present invention are directed to methods, apparatus and systems for creating a searchable electronic record, or “electronic manifest,” relating to a geographic area including a dig area to be excavated or otherwise disturbed. As part of the electronic record, the geographic location of one or more physical locate marks,

13

applied to the dig area during a locate operation to indicate a presence (or absence) of one or more located underground facilities, is somehow identified with respect to its immediate surroundings in the geographic area.

To create such an electronic record, in one exemplary implementation one or more input images relating to the geographic area including the dig area may be utilized. For example, source data representing one or more input images of a geographic area including the dig area is received and/or processed so that the input image(s) may be displayed on a display device. The geographic location of the physical locate mark(s) is then indicated in some manner on the displayed input image(s) so as to generate one or more marked-up images constituting at least a portion of the electronic record. For example, geographic locations of the physical locate mark(s) may be indicated in the marked-up image(s) using digital representation(s) of the physical locate mark(s) ("locate mark indicators") that are added to the marked-up image(s). In other implementations, the input image need not necessarily be displayed to add one or more locate mark indicators; for example, geographic information relating to one or more physical locate marks applied to the dig area may be received and locate mark indicator(s) may be added to the input image based on the geographic information, without requiring display of the input image.

In some implementations of the inventive concepts disclosed herein, the searchable electronic record may include a variety of non-image information regarding the locate operation (e.g., a text description of the geographic location of the dig area, an address or lot number of a property within which the dig area is located, geo-encoded information such as geographic coordinates relating to the physical locate mark(s) and/or various aspects of the geographic area surrounding the physical locate mark(s), a timestamp for the locate operation, one or more identifiers for a locate technician and/or a locate company performing the locate operation, information regarding one or more environmental landmarks, etc.). The marked-up image(s) and the non-image information may be formatted in a variety of manners in the searchable electronic record; for example, in one implementation the non-image information may be included as metadata associated with the marked-up image(s), while in other implementations the marked-up image(s) and the non-image information may be formatted as separate data sets. These separate data sets may be transmitted and/or stored separately. In another aspect, whether transmitted/stored separately or together, the marked-up image(s) and the non-image information may be linked together in some manner as relating to a common electronic record.

As may be observed from FIG. 1, an input image serving as a starting point for creating a searchable electronic record according to various embodiments of the present invention may be displayed (e.g., on a laptop computer), and the displayed input image provides a view of the geographic area including dig area 100 (which, in FIG. 1, is essentially an entire property surrounding a building). Various embodiments relating to the inventive concepts disclosed herein enable locate technicians or other users to indicate a geographic location of physical locate mark(s) applied to the dig area during a locate operation on one or more displayed input images. For purposes of the present disclosure, an input image is any image represented by source data that is electronically processed (e.g., the source data is in a computer-readable format) to display the image on a display device. An input image may include any of a variety of paper/tangible image sources that are scanned (e.g., via an electronic scanner) or otherwise converted so as to create source data (e.g., in

14

various formats such as XML, PDF, JPG, BMP, etc.) that can be processed to display the input image. An input image also may include an image that originates as source data or an electronic file without necessarily having a corresponding paper/tangible copy of the image (e.g., an image of a "real-world" scene acquired by a digital still frame or video camera or other image acquisition device, in which the source data, at least in part, represents pixel information from the image acquisition device).

In some exemplary implementations, input images according to the present disclosure may be created, provided, and/or processed by a geographic information system (GIS) that captures, stores, analyzes, manages and presents data referring to (or linked to) location, such that the source data representing the input image includes pixel information from an image acquisition device (corresponding to an acquired "real world" scene or representation thereof), and/or spatial/geographic information ("geo-encoded information"). In this manner, a GIS provides a framework for data manipulation and display of images that may facilitate one or more of (a) location verification, (b) location correlation, (c) locational relationships, (d) district coding, (e) route analysis, (f) area analysis and (g) mapping/display creation, for example.

In view of the foregoing, various examples of input images and source data representing input images according to the present disclosure, to which the inventive concepts disclosed herein may be applied, include but are not limited to:

Manual "free-hand" paper sketches of the geographic area (which may include one or more buildings, natural or man-made landmarks, property boundaries, streets/intersections, public works or facilities such as street lighting, signage, fire hydrants, mail boxes, parking meters, etc.). FIG. 10 shows an exemplary sketch 1000;

Various maps indicating surface features and/or extents of geographical areas, such as street/road maps (e.g., map 1100 of FIG. 11), topographical maps, military maps, parcel maps, tax maps, town and county planning maps, call-center and/or facility polygon maps, virtual maps, etc. (such maps may or may not include geo-encoded information);

Facility maps illustrating installed underground facilities, such as gas, power, telephone, cable, fiber optics, water, sewer, drainage, etc. Facility maps may also indicate street-level features (streets, buildings, public facilities, etc.) in relation to the depicted underground facilities. Examples of facility maps include CAD drawings that may be created and viewed with a GIS to include geo-encoded information (e.g., metadata) that provides location information (e.g., infrastructure vectors) for represented items on the facility map. An exemplary facility map 1200 is shown in FIG. 12;

Architectural, construction and/or engineering drawings and virtual renditions of a space/geographic area (including "as built" or post-construction drawings). An exemplary construction/engineering drawing 1300 is shown in FIG. 13;

Land surveys, i.e., plots produced at ground level using references to known points such as the center line of a street to plot the metes and bounds and related location data regarding a building, parcel, utility, roadway, or other object or installation. FIG. 14 shows an exemplary land survey map 1400;

A grid (a pattern of horizontal and vertical lines used as a reference) to provide representational geographic information (which may be used "as is" for an input image or as an overlay for an acquired "real world" scene, drawing, map, etc.). An exemplary grid 1500, overlaid on

15

construction/engineering drawing **1300**, is shown in FIG. **15**. It should be appreciated that the grid **1500** may itself serve as the input image (i.e., a “bare” grid), or be used together with another underlying input image;

“Bare” data representing geo-encoded information (geographical data points) and not necessarily derived from an acquired/captured real-world scene (e.g., not pixel information from a digital camera or other digital image acquisition device). Such “bare” data may be nonetheless used to construct a displayed input image, and may be in any of a variety of computer-readable formats, including XML); and

Photographic renderings/images, including street level (see e.g., street level image **1600** of FIG. **16**), topographical, satellite, and aerial photographic renderings/images, any of which may be updated periodically to capture changes in a given geographic area over time (e.g., seasonal changes such as foliage density, which may variably impact the ability to see some aspects of the image); and

An image, such as any of the above image types, that includes one or more dig area indicators, or “virtual white lines,” that provide one or more indications of or graphically delimit a dig area, as described in U.S. patent application Ser. No. 12/366,853, incorporated by reference herein. The virtual white lines may include lines, drawing shapes, shades, symbols, coordinates, data sets, or other indicators that are added to an image, and may assist a locate technician in the performance of a locate operation by identifying the area of interest, i.e., the dig area. In this manner, a searchable electronic record according to the concepts disclosed herein may be generated based on a previously marked-up input image on which the dig area is indicated.

It should also be appreciated that source data representing an input image may be compiled from multiple data/information sources; for example, any two or more of the examples provided above for input images and source data representing input images, or any two or more other data sources, can provide information that can be combined or integrated to form source data that is electronically processed to display an image on a display device.

As noted above, in some implementations an input image may be indexed to Global Positioning System (GPS) coordinates or another coordinate system that provides geo-spatial positioning. An input image may include geo-coding or other geographical identification metadata and may be provided in any computer-readable format. An input image may also include images of map symbols, such as roads and street names, that may be superimposed upon or displayed separately from an underlying geographic area when the input image is displayed on a display device.

With reference again to FIG. **1**, it may be observed that the dig area **100** is indicated in the displayed input image by a dig area indicator or virtual white line **150**. As noted above, in one embodiment the input image may have been received with one or more dig area indicators previously provided so that the dig area may be readily identified in the displayed input image. While FIG. **1** illustrates a virtual white line **150** as an essentially continuous line delimiting a boundary of the dig area, it should be appreciated that one or more dig area indicators are not limited in this respect, and that such indicators may include lines having various colors and line-types (dashed, dotted, etc.), drawing shapes, shades, symbols, etc., and need not necessarily delimit an entire boundary of a dig area. Additionally, as also noted above, it should be appreciated that in some embodiments an input image need not

16

include any dig area indicators to provide a foundation for generating a searchable electronic record of a locate operation.

In FIG. **1**, digital representations of the physical locate marks applied to a dig area (e.g., corresponding to power lines **110**, telecommunications lines **120** and gas lines **130** shown in FIG. **1**), may be added to the displayed input image to graphically indicate the geographic locations of the physical locate marks in the dig area **100**. Representations of the physical locate marks, also referred to as “locate mark indicators,” may be added to the displayed input image through the use of a drawing application or marking tool application, which may superimpose over or otherwise display one or more locate mark indicators on the displayed input image. As used herein, “representations of physical locate marks” or “locate mark indicators” may include lines, drawing shapes, shades, symbols, coordinates, data sets, or other indicators to provide one or more indications of the geographic locations of the physical locate marks on a displayed input image. As discussed further below, a given locate mark indicator may have an associated attribute representing a type of underground facility corresponding to the physical locate mark(s) applied to the dig area. Examples of different attributes for a locate mark indicator include, but are not limited to, color, line-type, symbol-type, shape, shade, etc. (e.g., a first locate mark indicator for a gas line may include a green dashed-line, a second locate mark indicator for a fiber optic cable may include a red dotted-line, a third locate mark indicator for an electric line may include one or more gray diamond shapes arranged along a path traversed in the input image by the buried electric line, etc.).

In some exemplary embodiments described herein, the marked-up images having one or both of locate mark indicators and dig area indicators (“virtual white lines”), as well as non-image information, may form part of the searchable electronic record, and information regarding the searchable electronic record (and in some instances the record itself) may be electronically transmitted and/or stored to facilitate verification of the locate operation. In one implementation, the non-image information may include a series of geographical coordinates representing the locate mark indicator(s). These marked-up images and coordinates enable documentation of where the physical locate marks were made, even after the physical locate marks no longer exist. Such documentation may be important in the event of accidental damage to an underground facility or another event triggering a dispute concerning whether the underground facilities were appropriately marked. Further, documentation provided by the searchable electronic records according to the present disclosure may be helpful for training locate technicians, assessing the quality of locate operations, and ensuring that locate operations have actually and/or accurately been performed without a need to visit the dig site thereafter. An electronic record comprising the marked-up image may be stored for later retrieval, and may be searchable. For example, data embedded within or otherwise associated with the marked-up image may be searchable (e.g., via a search engine) using key words.

Exemplary Network

FIG. **2** is a diagram of an exemplary network **200** in which systems and methods described herein may be implemented. As shown in FIG. **2**, the network **200** may include a user device **210** connected to a central server **220** and an image server **230** via a network **240**. A single user device **210**, central server **220**, and image server **230** have been illustrated

17

as connected to network **240** for simplicity. In practice, there may be more or fewer user devices and/or servers. For example, in one alternative implementation, the user device **210** may operate as a comprehensive device and, thus, the network **200** may include no central server, with user device **210** communicating directly through network **240** to image server **230**. Also, in some instances, the user device **210** may perform one or more of the functions of the central server **220** and/or central server **220** may perform one or more of the functions of the user device **210**. In still another implementation, multiple user devices **210** may be connected to the central server **220** through the network **240**.

The user device **210** may encompass a computer device, such as a laptop computer, a small personal computer, a tablet device, a personal digital assistant (PDA), a mobile computing device, a touch-screen device, or generally any device including or connecting to a processor and a display. The user device **210** may be portable so as to be separately carried by the user performing a locate operation. Alternatively, the user device **210** may be integrated with or affixed to another moveable object, such as a vehicle.

The central server **220** may include a computer device that may store information received from or provided to the user device **210** and/or the image server **230**. The central server **220** may include storage capacity and/or optionally include networked access to one or more separate hardware components, such as images cache **235**, to store cached images and the like.

The image server **230** may include a computer device that may store and provide input images of geographic locations. The image server **230** may be associated with the same, or a different, party that maintains the central server **220**. For example, the image server **230** may be associated with a party that provides input images for a fee.

The network **240** may include a local area network (LAN), a wide area network (WAN), a telephone network, such as the Public Switched Telephone Network (PSTN) or a cellular network, an intranet, the Internet, a communications link, or a combination of networks. The user device **210**, central server **220**, and image server **230** may connect to the network **240** via wired and/or wireless connections. The user device **210** and central server **220** may communicate using any communication protocol.

Exemplary User Device Architecture

FIG. 3 is a diagram of exemplary components of the user device **210**. The user device **210** may include a bus **310**, a processing unit **320**, a memory **330**, an input device **340**, an output device **350** (e.g., a display device), a location identification unit **360**, and a communication interface **370**. In another implementation, the user device **210** may include more, fewer, or different components. For example, the location identification unit **360** may not be included, or the location identification unit **360** may be included as a device located external to the user device **210**, such as a device worn or carried by a user of the user device **210**.

The bus **310** may include a path that permits communication among the components of the user device **210**. The processing unit **320** may include a processor, a microprocessor, or processing logic that may interpret and execute instructions. The memory **330** may include a random access memory (RAM), a read only memory (ROM), a memory card, a magnetic and/or optical recording medium and its corresponding drive, or another type of memory device. Generally, the memory **330** may be sufficient to store and manipulate input images, such as those stored in a local image cache **335**. In

18

one implementation, the local image cache **335** may include one or more input images of a dig area to be marked by a user. In another implementation, the local image cache **335** may include a series of input images that correspond to the geographical region to which a particular user is assigned. For example, local image cache **335** may include a collection of high-resolution images of a particular zip code or town. In still another implementation, the local image cache **335** may include an entire set of input images intended to be made available to multiple users.

The input device **340** may include one or more mechanisms that permit a user to input information to the user device **210**, such as a keyboard, a keypad, a touchpad, a mouse, a stylus, a touch screen, a camera, or the like. Alternatively, or additionally, the input device **340** may include a microphone that can capture a user's intent by capturing the user's audible commands. Alternatively, or additionally, the input device **340** may interact with a device that monitors a condition of the user, such as eye movement, brain activity, or heart rate. The output device **350** may include a mechanism that outputs information to the user, such as a display, a speaker, or the like. The condition information may be used to assess the reliability of the user inputs that are used to generate the marked-up image or other aspects of the electronic record. For example, if the monitored heart rate of the user is sufficiently high as to indicate that the user is under stress, the reliability of the user inputs may be assessed as poor.

The location identification unit **360** may include a device that can determine its geographic location to a certain degree of accuracy, such as a global positioning system (GPS) or a global navigation satellite system (GNSS) receiver. In another implementation, the location identification unit **360** may include a device that determines location using another technique, such as tower (e.g., cellular tower) triangularization. The location identification unit **360** may receive location tracking signals (e.g., GPS signals) and determine its location based on these signals. In one implementation, location identification unit **360** may be capable of determining its location within approximately thirty centimeters or less.

The communication interface **370** may include any transceiver-like mechanism that enables user device **210** to communicate with other devices and/or systems. For example, the communication interface **370** may include mechanisms for communicating with another device or system via a network. For example, the communication interface **370** may enable communications between the user device **210** and the central server **220** and/or image server **230** over network **240**.

As will be described in detail below, user device **210** may perform certain operations relating to the documentation of locate operations and/or the creation of an electronic manifest. User device **210** may perform these operations in response to the processing unit **320** executing software instructions contained in a computer-readable medium, such as the memory **330**. A computer-readable medium may be defined as a physical or logical memory device.

The software instructions may be read into the memory **330** from another computer-readable medium, or from another device via the communication interface **370**. The software instructions contained in the memory **330** may cause processing unit **320** to perform processes that will be described later. Alternatively, hardwired circuitry may be used in place of, or in combination with, software instructions to implement processes described herein. Thus, implementations described herein are not limited to any specific combination of hardware circuitry and software.

Exemplary Central Server Architecture

FIG. 4 is a diagram of exemplary components of the central server **220**. The central server **220** may include a bus **410**, a

19

processing unit **420**, a memory **430**, and a communication interface **440**. In another implementation, the central server **220** may include more, fewer, or different components. For example, an input device and/or an output device (not shown) may be included, as necessary.

The bus **410** may include a path that permits communication among the components of the central server **220**. The processing unit **420** may include a processor, a microprocessor, or processing logic that may interpret and execute instructions. The memory **430** may include a magnetic and/or optical recording medium and its corresponding drive, a RAM, a ROM, a memory card, or another type of memory device suitable for high capacity data storage. Generally, the memory **430** may be sufficient to store input images of particular geographic locations, such as those stored in a central image cache **435**. In one implementation, the central image cache **435** may include a set of input images that correspond to the geographical regions to which a group of users are assigned. In still another implementation, the central image cache **435** may include the entire set of input images intended to be made available to any of a group of users. For example, central image cache **435** may include a collection of high-resolution input images of a particular county, state or other geographic region. In another implementation, as shown in FIG. 2, central image cache **435** may be replaced or supplemented with one or more networked storage components, such as image cache **235**.

The communication interface **440** may include any transceiver-like mechanism that enables the central server **220** to communicate with other devices and/or systems. For example, the communication interface **440** may include mechanisms for communicating with another device or system via a network. For example, the communication interface **440** may enable communications between the central server **220** and the user device **210** and/or image server **230** over network **240**.

As will be described in detail below, the central server **220** may perform certain operations to facilitate the documentation of locate operations and/or the creation of an electronic manifest. The central server **220** may perform these operations in response to the processing unit **420** executing software instructions contained in a computer-readable medium, such as the memory **430**.

The software instructions may be read into the memory **430** from another computer-readable medium, or from another device via the communication interface **440**. The software instructions contained in the memory **430** may cause processing unit **420** to perform processes that will be described later. Alternatively, hardwired circuitry may be used in place of or in combination with software instructions to implement processes described herein. Thus, implementations described herein are not limited to any specific combination of hardware circuitry and software.

Exemplary Routines

FIG. 5 is a diagram of exemplary software routines for the components shown in FIG. 2. The central server **220** may include an image retrieval routine **520** and a central image cache routine **510**. The user device **210** may include a synchronize routine **530**, a local image cache routine **540**, an image display routine **550**, a user input routine **560**, and a ticket manager routine **570**. As discussed in more detail herein, the examples of routines associated with the central server **220** and the user device **210** may be interchangeable between each hardware component. Furthermore, some or all

20

of routines **510**, **520**, **530**, **540**, **550**, **560**, and **570** need not be performed exclusively by any one hardware component.

Still referring to FIG. 5, the image server **230** may store a library of input images. Generally, input images such as aerial images may be of sufficient resolution at an optimal elevation to be useful as a record of the locate operation. The input images from the image server **230** may include geocoding or other geographical identification metadata and may be provided in any computer-readable format, such as JPEG file interchange format (JPEG), tagged image file format (TIFF), portable document format (PDF), graphics interchange format (GIF), bitmap (BMP), portable network graphics (PNG), Windows® metafile (WMF), and/or the like. Also, input images from the image server **230** may include a combination of images or overlays, such as overlays of street names, regions, landmark descriptions, and/or other information about areas displayed in an image. The input images from the image server **230** may be supplied by a third-party provider if the coverage area of the third-party image provider overlaps with the desired area of the user.

The central image cache routine **510** and the image retrieval routine **520** of the central server **220** may include a variety of functionalities. In certain implementations, the central image cache routine **510** may receive information about specific tickets and parse tickets in order to discern location information. For example, a ticket may identify the dig area by an address of the property or by geographic coordinates. The ticket might specify, for example, the address or description of the dig area to be marked, the day and/or time that the dig area is to be marked, and/or whether the user is to mark the dig area for telecommunications (e.g., telephone and/or cable television), power, gas, water, sewer, or some other underground facility.

The central image cache routine **510** may also convert dig area location information to latitude/longitude coordinates or other coordinates. When location information from a ticket is sufficiently precise to allow for identification of corresponding imagery, the central image cache routine **510** may calculate the image extent (which may be generally defined as the bounding region of the dig area of interest), and update the ticket with the calculated extent. In one implementation, the central image cache routine **510** may determine image date, coordinates, and resolution of each image that may be stored in the central image cache **435** or in another location. In another implementation, when location information from a ticket is imprecise (or “fuzzy”), the central image cache routine **510** may mark the ticket to indicate that no corresponding image was able to be retrieved based on the ticket information.

In another implementation, central image cache **510** may identify an image to retrieve based on GPS coordinates of a GPS-enabled device associated with a user. For example, a user may arrive at an excavation site in a GPS-enabled vehicle and the GPS information from the vehicle may be used to identify coordinates corresponding to an image to be retrieved. GPS coordinates may also be obtained from other GPS-enabled devices being used by or in the vicinity of the user. As used herein a GPS-enabled device may include any device or combination of devices capable of interfacing with a global navigation satellite system, geo-spatial positioning system, or other location-identification system to determine a location. Examples of GPS-enabled devices may include a marking device (e.g., a paint wand) with an integrated GPS receiver; a locating device (e.g., a locating wand) with a GPS receiver; a wearable GPS-enabled device; a vehicle-mounted GPS system; certain PDAs, computers, and cellular telephones; and stand-alone GPS-enabled systems.

21

In still another implementation, central image cache **510** may identify one or more images to request based on a designated geographical area assigned to a user. For example, a user may be assigned to work in several dig areas associated with a particular section of a neighborhood. The user may input coordinates associated with the entire selected section of the neighborhood, and central image cache **510** may then retrieve images for those coordinates.

The image retrieval routine **520** catalogues and stores images from the image server **230** to the central server **220**. For example, images may be stored in the central image cache **435** in the memory **430** of the central server **220**. In one implementation, the image retrieval routine **520** may query the central image cache **435** or other cache for an image associated with a particular dig area relating to a ticket of interest, and determine, based on (for example) the age and resolution of the cached image, whether the image in the central image cache **435** needs to be updated from the image server **230**.

In another implementation, the image retrieval routine **520** may interface with multiple image providers and image servers **230**. The image retrieval routine **520** may determine which image provider is the best source for the image corresponding to a particular dig area relating to a ticket of interest based on algorithms that factor, for example, each image provider's geographical coverage, image resolution, cost, and availability. Regarding geographical coverage, it will be beneficial to confirm that the image provider's area of coverage includes the desired extent (in other words, the entire geographical region of interest to the user).

Regarding image resolution, available resolution may be measured in meters (or centimeters, feet, or inches) per pixel. For example, one provider may offer thirty centimeters per pixel, while another offers fifteen centimeters or less per pixel, for the same coverage area. If an image is requested at a standard altitude, then the image retrieval routine **520** may choose a pre-defined optimal scale (for example, thirty centimeters per pixel for a rural area, but fifteen centimeters per pixel for an urban area) and determine which provider provides images at the pre-defined optimal scale. Alternatively, if the image of interest is at a less granular scale (for example, a community or neighborhood image that allows the locator to pan around the image), then resolution may not be a significant factor.

Regarding cost, the image retrieval routine **520** may have access to pricing information for a variety of image providers. The image retrieval routine **520** may identify which provider has the lowest cost for the desired image. Cost analysis may be based on images desired for an individual ticket or the algorithm may account for a group of image requests, including volume incentives and/or penalties from each image provider.

Regarding availability of image providers, the image retrieval routine **520** may identify what providers are available and/or operational. Also, if an image provider has a regular latency profile (for example, if a provider has a particular server that is busiest 3-5 PM Pacific time), then the image retrieval routine **520** may manage requests to be provided to another image provider or to a particular server of that image provider to efficiently load share the image retrieval.

When an image provider is selected, the image retrieval routine **520** may download the image from the selected image provider's server, which may be an image server **230**. The downloaded image may be stored locally, for example, in the central image cache **435**.

22

It should be understood that some of the routines and/or functionalities described above with respect to the central image cache routine **510** and the image retrieval routine **520** may be performed by one or both of the routines **510** and **520** above, and the arrangement of functionalities are not limited to the implementations disclosed herein.

The synchronize routine **530** for user device **210** may ensure that images already stored and manipulated on the user device **210** correspond to images stored in the central server **220**. When a user performing a locate operation identifies a ticket or dig area, the synchronize routine **530** may check if an image exists in the central server **220** that matches the extent requested, and if the matching image is up-to-date in, for example, the local image cache **335**. The synchronize routine **530** may also synchronize images from the central server **220** cache and store copies locally in the user device **210**.

If the ticket has a valid extent (i.e., a recognizable boundary), the local image cache routine **540** may associate the ticket information with an image matching the extent. The local image cache routine **540** may load the image from the local image cache **335**. If the ticket does not have a valid extent, the local image cache routine **540** may accept address information that is entered by the user. Alternatively, the local image cache routine **540** may read the local address information from the ticket or from a GPS-enabled device in communication with the user device **210** so that address information may be pre-entered for the user to the extent possible. Address information may include, for example, a street address, street name, city, state and/or zip code. If either none or multiple stored addresses appear to be associated with particular address information, the local image cache routine **540** may display a list of best match addresses from which a user can select.

Once an image is loaded from the local cache **335**, image display routine **550** may provide a variety of view options for the user. For example, the image display routine **550** may support zooming in and out of the image by changing the image scale. Also, the image display routine **550** may support panning horizontally and vertically in the image. Furthermore, the image display routine **550** may support "roaming" outside the boundaries of the initial extent. Roaming generally occurs when the user zooms or pans, such that images beyond the boundaries of the stored images may be required to be retrieved (using, for example, synchronize routine **530**) from either the local image cache **335** or the central server **220**. The additional images retrieved from either the local image cache **335** or the central server **220** may be displayed and stitched together to display a complete image.

The user input routine **560** allows the user to add information to the image to create an electronic manifest. The user input routine **560** may accept user input from, for example, input device **340**, and may support the addition of lines, freehand forms (or scribbling), shapes such as circles and rectangles, shading, or other markings which denote the approximate location of underground facilities which are present within the dig area. A drawing shape may generally be any kind of drawing shape or mark. The user input routine **560** may further enable drawing of underground facility locate marks for telecommunications (e.g., telephone and cable television), gas, power, water, sewer, and the like, so that each type of drawn locate mark is distinguishable from the other(s). The user input routine **560** may limit the display of such facilities by the type of work which is to be performed according to the instructions included within the user's assigned ticket. Accordingly, a given locate mark indicator, serving as a digital representation of a physical locate mark applied to the dig area, may have an associated attribute representing a

23

type of underground facility corresponding to the physical locate mark. Examples of different attributes for a locate mark indicator include, but are not limited to, color, line-type, symbol-type, shape, shade, etc. (e.g., a first locate mark indicator for a gas line may include a green dashed-line, a second locate mark indicator for a fiber optic cable may include a red dotted-line, a third locate mark indicator for an electric line may include one or more gray diamond shapes arranged along a path traversed in the input image by the buried electric line, etc.).

In addition to the marking of the underground facility locate marks on the input image, user input routine 560 may also include offsets from environmental landmarks that may be displayed on the image in, for example, English or metric units. Environmental landmarks may also be marked and/or highlighted on the input image. The user input routine 560 may also accept positioning information from external sources, such as a GPS-enabled device. The user input routine 560 may further include features to annotate the image with text and to revise user inputs by, for example deleting, dragging or pasting shapes. In one implementation, when the user zooms the image view in or out, user input (e.g., lines and/or shapes) that have been added to the original image may adhere to the changing image scale and remain in the original user-input locations.

The electronic manifest, which is a compilation of one or more input images and user inputs, may be saved as an image file. In another implementation, the user inputs may be saved in a mark-up format, including the geo-coordinates and underground facility type of each input.

In one implementation, the user device 210 may interface with a ticket management program for coordinating multiple tickets. The ticket manager routine 570 may facilitate such an interface. The ticket management program for coordinating multiple tickets may reside on the central server 220, for example, or on a separate server that is accessible to the user device 210. Generally, tickets may be stored on a central server and assigned to a user. When a user edits a ticket, the user may also have created an electronic manifest associated with the ticket. The ticket manager routine 570 may allow the user to synchronize the user's ticket cache with the company's central database and also synchronize the images and user input. The ticket manager routine 570 may copy images from the central server 220 to the user device 210 for new tickets, and will copy the user input from the user device 210 to the central server 220 for completed tickets. The ticket manager routine 570 may interface with the routines described above to correlate a user's assigned tickets with images for those tickets and download the images to the user device from the central server 220. The ticket manager routine 570 may retrieve the corresponding ticket number from the ticket management program when the user retrieves an image, or the ticket manager routine 570 may retrieve the image corresponding to an entered ticket number.

FIG. 6 provides a flowchart 600 of an exemplary process for creating an electronic manifest relating to a locate operation and the application of locate marks to a dig area to indicate a presence (or absence) of one or more underground facilities. In one implementation, at least some of the blocks of FIG. 6 may be performed using user device 210 (FIG. 2). In another implementation, one or more of the blocks of FIG. 6 may be manually performed or performed by another device, such as central server 220.

The process 600 may begin with a user being dispatched to a dig area to be located, in response to a locate request ticket being generated for a locate operation. For example, the user might be given a ticket that identifies what underground

24

facilities the user needs to locate at the dig area. The ticket might specify, for example, the address or description of the dig area to be located, the day and/or time that the dig area is to be located, and/or whether the user is to locate the dig area for telecommunications, power, gas, water, sewer, or other underground facility. Based on information in the ticket, or other information about the dig area to be located, user device 210 in block 610 may associate the property address with a stored input image of the dig area. Such association may include associating the address with geographic location information, such as global positioning coordinates for the dig area extent (or boundary).

In one exemplary embodiment, the locate request ticket may be an electronic locate request ticket that comprises a previously marked-up image of a geographic area including the dig area, on which one or more dig area indicators, or "virtual white lines," were placed (e.g., by an excavator or a one-call center) to provide an indication of the dig area. In this manner, an electronic locate request ticket received by a locate company or locate technician may include both image data and non-image data; for example, a locate request ticket may include a marked-up image with one or more dig area indicators, as well as associated non-image information providing additional details of the locate operation to be performed, as noted above. Further details of locate request tickets including marked-up images with one or more dig area indicators are given in U.S. patent application Ser. No. 12/366,853, filed Feb. 6, 2009, entitled "Virtual White Lines for Indicating Planned Excavation Sites on Electronic Images," which application is incorporated by reference herein.

In block 620, the stored input image associated with the dig area to be located is retrieved from a cache of images and loaded into the user device 210. As previously described and discussed herein with respect to FIG. 5, the cache of images may reside within the user device 210, the central server 220, a separate image server, or another storage device. As discussed above, the input image may be represented by a wide variety of source data that, when processed, facilitates display of the input image. In one exemplary implementation, the input image for the searchable electronic record may be a previously marked-up image with one or more dig area indicators or virtual white lines; in one aspect, such an input image may be received as part of the locate request ticket specifying the locate operation. In various implementations, it should be appreciated that the input image may or may not be displayed, as discussed further below.

In block 630, the user may perform a locate operation to locate the underground facilities present within the dig area and mark the located underground facilities using a locating device and/or marking device, or a combined locating/mark-ing device. For example, the user may use the locating device to identify an underground facility at the dig area, and may use the marking device to mark the underground facility with the appropriate marker (e.g., color paint, flag, or some other object). In certain implementations, information regarding the approximate geographic location of the applied underground facility locate marks may be gathered and stored electronically using a GPS-enabled device or other location identification device. The approximate geographic location of the underground facility locate marks may be determined, for example, by identifying the current geographic location of the GPS-enabled device as the user performs the locating or marking. In another implementation, a user may use a triangularization technique to determine the approximate geographic location of the underground facility locate marks. In

25

yet another implementation, a user may determine latitude and longitude coordinates or some other measurement of a geographic location.

In block 640, information about the approximate geographic location of the underground facility locate marks may be added to the input image that was retrieved previously in block 620. The information about the approximate geographic location of the underground facility locate marks may be input by the user using an input device, such as input device 340 (FIG. 3) of user device 210, and added to the displayed input image as one or more locate mark indicators. In one exemplary implementation in which the input image is a previously marked-up image having one or more dig area indicators, this image may be further marked-up to add one or more locate mark indicators that are displayed together with the one or more dig area indicators. Additional aspects regarding information to be input by the user are discussed in more detail herein with respect to FIG. 8.

Still referring to block 640, information about the approximate geographic location of the underground facility locate marks may also be received directly from a GPS-enabled device, such as the GPS-enabled locating device or marking device used in block 630, and overlaid on the input image. In one exemplary implementation, one or more locate indicator marks based on this information may be added to the input image automatically, and in some instances without any requirement to display the input image. Alternatively, the user may use of a combination of received GPS information and manual entries to create an electronic manifest of the underground facility locate marks.

In block 645, as an optional step, information about offsets of the underground facility locate marks from environmental landmarks may be added to the input image. As with the input of the facility locations in block 640, the location of the environmental landmarks may be input by the user using an input device, such as input device 340 (FIG. 3) of user device 210, or automatically input from a GPS-enabled device. The offset information may be automatically calculated or input by the user. Offset information may also be obtained by identifying selected environmental landmarks on the retrieved image and automatically calculating the distance from the selected environmental landmarks to the underground facility locate marks overlaid on the image.

In block 650, as an optional step, information about the location of the underground facility locate marks (e.g., the locate mark indicators added to the input image) may be converted to GPS coordinates. In block 660, the marked-up input image and other information (e.g., non-image information) about the location operation may be stored in memory as a searchable electronic record or “electronic manifest,” which may be formatted as a single combined image (e.g., image data and non-image metadata) or as separate image data and non-image data that are linked. In exemplary implementations, the electronic manifest may be stored as, for example, a digital image or an interactive electronic map. Additionally or alternatively, in block 670, the geographical coordinates of the underground facility locate marks may be stored in memory, such as memory 330 (FIG. 3), as a separate data set. The data set may be compiled as, for example, a database of GPS coordinates. In block 680, the combined image and/or separate data set may optionally be transmitted to a central location, such as central server 220 (FIG. 2).

Thus, the marked-up image(s) and the non-image information may be formatted in a variety of manners in the searchable electronic record; for example, in one implementation the non-image information may be included as metadata associated with the marked-up image(s), while in other

26

implementations the marked-up image(s) and the non-image information may be formatted as separate data sets. These separate data sets may be transmitted and/or stored separately. In another aspect, whether transmitted/stored separately or together, the marked-up image(s) and the non-image information may be linked together in some manner as relating to a common electronic record.

In some locate operations, no underground facilities are determined to be present in a designated dig area. Such locate operations are sometimes referred to as “clears.” In some implementations of the inventive concepts discussed herein, an input image may nonetheless be employed to provide an electronic record of a “clear;” more specifically, although no locate mark indicators may be added to an input image (i.e., the step 640 may not be necessary because there are no physical locate marks to digitally represent), other non-image information associated with the “clear” locate operation (e.g., a timestamp of when the locate operation was performed, an identifier for a technician or locate company performing the locate operation, a text address or other geographical identifier for the dig area, a location stamp, etc.) may be associated with the input image (e.g., as a separate data set linked to the input image, as metadata, a combined file of image and non-image data, etc.) to create a searchable electronic record that may be consulted to verify that the locate operation was indeed completed, even though no underground facilities were found.

FIG. 7 is a diagram of an exemplary data set that may be stored in memory 330 and/or transmitted to server 220. As shown in FIG. 7, a data set 700 may include a timestamp field 710, an underground facility identifier field 720, an underground facility location field 730, an environmental landmark identifier field 740, an environmental landmark location field 750, an other information field 760, a facility owner/operator field 765, a marking method field 770, a property address field 780, a ticket number field 790, a location stamp field 715, and a certification field 725. In another implementation, the data set 700 may include additional, fewer, or different fields.

Timestamp field 710 may include time data that identifies the day and/or time that a locate operation was performed. This may coincide with a time at which an environmental landmark location was identified in connection with the dig area. The time data in timestamp field 710 is shown in FIG. 7 as 9:43 a.m. on Oct. 20, 2005—although any type of date and/or time code may be used. The information in timestamp field 710 may be useful in establishing when a locate operation occurred.

The underground facility identifier field 720 may include an identifier that uniquely identifies the type of underground facility that was marked. The identifier in underground facility identifier field 720 is shown in FIG. 7 as “power”—although any type of identifier may be used. Underground facility location field 730 may include geographic location information corresponding to an underground facility locate mark. In one implementation, the geographic location information may include a set of geographic points along the marking path of the located underground facility. The geographic location information in underground facility location field 730 is shown in FIG. 7 as N38°51.40748, W077°20.27798; . . . ; N38°51.40784, W077°20.27865—although any type of geographic location information may be used. The information in underground facility location field 730 may be useful in graphically presenting the underground facility locate marks on a map, and/or to verify that the locate operation was actually and accurately performed. Additionally, or alternatively, underground facility location field 730

may include geographic location information for multiple underground facility locate marks.

Environmental landmark identifier field **740** may include an identifier that uniquely identifies the type of environmental landmark being marked. The identifier in environmental landmark identifier field **740** is shown in FIG. 7 as “curb”—although any type of identifier may be used.

Environmental landmark location field **750** may include geographic location information corresponding to the environmental landmark identified in environmental landmark identifier field **740**. The geographic location information in environmental landmark location field **750** is shown in FIG. 7 as N38°51.40756, W077°20.27805; . . . ; N38°51.40773, W077°20.27858—although any type of geographic location information may be used.

Other information field **760** may store other data that may be useful, including user notes, such as offset or distance information that identifies a distance between one or more environmental landmarks and one or more underground facility locate marks. Other information field **760** is shown in FIG. 7 as including “1.2 meters between curb and power line”—although any other data may be used. Additionally and/or alternatively, other information field **760** may include audio/voice data, transcribed voice-recognition data, or the like to incorporate user notes.

The underground facility owner field **765** may include the name of the owner/operator of the underground facility that has been marked during the locate operation. For example, in FIG. 7, the underground facility owner field **765** is shown as “ABC Corp.” Because multiple underground facilities may be marked during a single locate operation, it may be beneficial to associate each marked underground facility with a particular owner/operator. Alternatively, this field may include one or more identifiers for the locate company performing the locate operation, or an additional field may be added to the data set **700** for this purpose.

Marking method field **770** may indicate the type of marking used at the dig area to indicate the location of an underground facility. For example, in FIG. 7, marking method field **770** is shown indicating red paint. Property address field **780** may be the property address associated with the marking recorded in the data set **700**. The property address field **780** may include, for example, the street address and zip code of the property. Other information in field **780** may include city, state, and/or county identifiers. The ticket number field **790** may include the ticket number associated with the locate operation, such as ticket “1234567” shown in FIG. 7.

Location stamp field **715** may include a location stamp indicating a location where the locate operation was performed (e.g., the dig area). The location stamp may optionally be generated at the same time as timestamp **710**, and the information underlying these stamps may be from a same source or otherwise correlated, such that the location stamp reflects the location of the locate technician, user device, or associated locate and/or marking device when the timestamp **710** is generated. The location stamp may comprise, for example, location coordinates (as shown in FIG. 7), a city name or designation, a state name or designation, a county name or designation, and/or an address. Generally, the location stamp identifies the presence and location of a locate technician in connection with the locate operation.

According to one exemplary implementation, location stamp data is generated by the user device (e.g., by location identification unit **360**) in response to an action associated with a locate operation (e.g., a marking being made on the electronic manifest, creation of a new electronic manifest, completion or certification of an electronic manifest).

According to another exemplary implementation, location stamp data is generated by a GPS-enabled device associated with a locate technician dispatched to perform a locate operation (e.g., a GPS-enabled device in the vehicle and/or on the person of the locate technician), a GPS-enabled locate and/or marking device operated by the technician during the locate operation, or another locate and/or marking device capable of determining its own location. The location stamp data may then be transmitted from the GPS-enabled device or locate and/or marking device to the user device alone or in association with other data (e.g. marking data or locate data). The transmission may occur, for example, in response to a request by the user device, a request by the user, or some triggering action. The location stamp data may be recorded to the data set automatically (e.g., without user intervention) or in response to user input.

It should be appreciated that both the timestamp field **710** and location stamp field **715** may optionally include a plurality of timestamps and location stamps. For example, each of a plurality of actions (e.g., markings on the electronic manifest, actuations of the locate and/or marking device) may be associated with a particular time stamp and/or location stamp recorded in fields **710** and **715** so that the time and location of various actions associated with the locate operation can subsequently be determined. The actions may cause the time stamp and/or location stamp to automatically be logged. Further, the timestamp field **710** and/or location stamp field **715** may optionally be “read only” fields. Prohibiting changes to these fields (e.g., by the locate technician) may preserve the integrity of the data therein so that it can be reliably used for verification of the locate operation.

Certification field **725** may comprise a certification of the data in data set **700**, e.g., by the locate technician and/or another reviewer, such as a supervisor or other authorized representative of the locate company. Such a certification may comprise a signature, initials, an electronic stamp, or some other indication that the information in the data set **700** is “certified” (e.g., has been reviewed and/or is correct/approved).

In one implementation, the user device **210** may store multiple data sets corresponding to multiple underground facilities identified at a particular dig area. User device **210** may provide the data sets to server **220** in a batch—such as a batch corresponding to the group of underground facilities documented within the electronic manifest—or individually. The batch may be grouped together with other information generally relating to the locate operation, such as the name of the company responsible for performing the locate operation, the name of the locate technician, and the like. Additionally, or alternatively, the other information generally relating to the locate operation may be included in each data set.

FIG. 8 is an exemplary diagram of a user interface **800** that may be presented via the user device **210**. The user interface may be presented on a screen **800** that may be the screen of the user device **210**, as described herein with respect to FIG. 2. The screen **800** may display a variety of graphical elements, including but not limited to: a map control **810**, an address search panel **820**, a locator palette **830**, a navigation palette **840**, a status bar **850**, a menu bar **860**, a service grid **870**, a scale bar **880**, and the input image of the geographic area including the dig area. As discussed above, the displayed input image may include one or more dig area indicators or virtual white lines **890** to identify the dig area in the displayed image.

Map control **810** generally may be the surface, or canvas, where images—such as an exemplary image **802**—are displayed. The user may draw or input shapes “on top of” this

29

surface using for example, the input device **340** of FIG. 3 to identify underground facility locate mark locations. FIG. 8 shows a stylus **804** as an exemplary form of input device **340**.

The address search panel **820** may be used to identify images corresponding to a desired address. Panel **820** may, for example, accept a partial or complete address and allow the user to search for matches. If an excessive number of addresses match the search, then the size of the result set may be constrained. Address search results may be displayed which match the address search. The listed matches may serve as a springboard for displaying the image desired by the user. For example, when the user taps with a stylus **804** on an address match, the user device **210** may load the image corresponding to the selected address. As described above, this image may be stored locally on user device **210** or retrieved from central server **220**.

Palettes may be generally defined as a toolbar or toolbars containing soft buttons or other controls that are grouped in some logical order. The buttons on a palette may duplicate the commands available on the menu bar **860**. The locator palette **830** may allow the user to select the type of underground facility locate marks (e.g., electric, gas, water, sewer, telecommunications, etc.) the user will draw on the image **802**. The locator palette **830** may also include a choice of various shapes or shades, such as freestyle, line, circle, rectangle, or other polygon that the user may select to draw on the image **802**. In one implementation, the locator palette **830** may present a list of potential environmental landmark identifiers. In this case, the user may select an environmental landmark identifier from the list to overlay at the appropriate place on the input image **802**.

The locator palette **830** may also include an offset tool that allows the user to mark the distance between, for example, an environmental landmark identifier and a drawn underground facility locate mark. Once the user has chosen the type of shape they wish to draw (freestyle, line, polygon, shading etc.) the application may track the user's movements to define the layout and location of the shape. The shape may be completed when the user terminates the drawing (for example, by lifting the stylus **804** or releasing the mouse button). A text label or other indicator may be added to the shape automatically based on the type of underground facility locate mark or environmental landmark selected (e.g., "electric" or "curb") or may be manually added.

The navigation palette **840** may allow the user to zoom or pan the image **802**. For example, the navigation palette **840** may include selections to zoom in, zoom out, or zoom to a selected section of the image. The navigation palette **840** may also include pan command buttons to pan left, pan right, pan up or pan down. Other selections that may be available on the navigation palette include buttons to alter the transparency of either the image **802** or the underground facility locate marks.

The status bar **850** may display information about the map control, such as the coordinates of the subject area, the coordinates of a cursor or stylus in relation to the image **802**, and the image scale. The menu bar **860** may include an operating system element that allows a user to access commands, such as exiting the application, selecting what palettes or panels to display, or accessing online help.

The service grid **870** is shown as an exemplary "floating" window to show how the user interface for the screen **800** may operate in a typical operating system environment. The service grid **870** or any of the other graphical elements described in relation to screen **800** may be in a fixed or floating orientation. As underground facility locate marks are drawn on the map control **810**, they may appear in a list in the service grid **870**. Thus, the user may edit the properties of an underground

30

facility shape using the service grid **870**, as well as by selecting the shape in the map control **810**. The service grid may include properties, such as the type, length, circumference, and material of the marked underground facility.

FIG. 9 shows an exemplary searchable electronic record or electronic manifest **900** that may be generated according to methods and apparatus described herein. The electronic manifest comprises image data or information including a marked-up image **905**. In the example of FIG. 9, the marked-up image **905** includes digital representations **910** (locate mark indicators) of physical locate marks, offset indicia **915**, and virtual white lines **920** (dig area indicators). In addition, the electronic manifest **900** comprises non-image information relating to the locate operation, derived from one or more of the fields of the exemplary data set **700** illustrated in FIG. 7. In the example of FIG. 9, the displayed elements of such a data set constituting non-image information include (but are not limited to) a ticket number **925** for the locate operation (from the ticket number field **790**), an identifier **930** of the locate technician (e.g., from the field **765** or another similar field, which may indicate facility owner/operator, or locate company/technician), a time and date stamp **935** indicating when the electronic manifest was created (from the timestamp filed **710**), a location stamp **940** indicating where the electronic manifest was created (from the location stamp field **715**), a completed checklist **945** of markings used in the locate operation (from the marking method field **770**), and a locate technician signature **950** certifying that the information of the electronic manifest is correct (from the certification field **725**). The marked-up image and additional information relating to the locate operation may be stored as a single file (e.g., a combined image or image and text file), in associated files, or separately. It should be appreciated that the electronic manifest **900** shown FIG. 9 is merely exemplary, and that an electronic manifest as described herein may alternatively include other combinations of the information described herein and may be formatted in different manners.

An electronic manifest of underground facility locate marks may serve several purposes. For example, the electronic manifest may provide significant improvements in accuracy and save time for the locate technician. Manual sketching is time consuming and imprecise. For example, with manual sketching, the general geographic features of the dig area location, i.e. roads, sidewalks, landscaping, buildings, and other landmarks, must be reproduced by the locate technician. Creation of an electronic manifest that includes drafting on retrieved input images may improve accuracy and eliminate drafting of these general geographic features.

Additionally, or alternatively, an electronic manifest of underground facility locate marks may provide a variety of data formats from a single user event. For example, electronic drafting creates data about the electronic manifest which can be reviewed without viewing the image. The type of marked underground facilities can be determined based upon the existence of different colors, different line types (e.g., solid, dotted or dashed), or other coding schema. Length of marks for each underground facility can be approximated, and the existence and length of offsets detected. If available, the location of the marks can be cross-checked to the user's description or depiction of the area to be marked or excavated.

Additionally, or alternatively, an electronic manifest of underground facility locate marks may provide for easier dissemination and record-keeping. Electronic manifests can be associated with individual tickets and recalled electronically, avoiding the uncertainties and errors associated with manual filing systems. Furthermore, electronic manifests can be interrogated to ensure that the information recorded on the

electronic manifest accurately comports with billing data or other information regarding the locate operation(s) performed.

Additionally, or alternatively, information from the electronic manifest regarding the distance between environmental landmarks and located underground facility locate marks may be used to verify subsequent locate operations or the accuracy of the electronic manifest. For example, if the information identifies an underground facility as running parallel to the curb at a distance of three meters, that information may be used to assess the accuracy or consistency of a subsequent locate operation at the same dig area or, upon inspection, the accuracy of the electronic manifest.

Additionally, or alternatively, information from the electronic manifest regarding the number and types of underground facilities may be used to estimate the scope of a subsequent locate operation to be performed at a dig area. For example, a large number of underground facilities may be indicative of an extensive (i.e., time-consuming) locate operation.

Additionally, or alternatively, information from the electronic manifest may be used by a quality control supervisor and/or damage inspector to verify the accuracy of the underground facility locate marks. For example, if the user who performed a locate operation indicated that an underground facility runs parallel to a driveway at a distance of two meters, then the quality control supervisor or damage inspector may use this information to verify whether the marks properly reflected the actual location of the underground facilities present within the dig area. Also information from the electronic manifest may be used to train a user and/or to perform quality control relating to a user's work. The electronic manifest can be modified, e.g., after retrieval from the memory of a central server or the user device itself, to include indication of that the manifest has been reviewed and/or approved (e.g., by quality control supervisor). Such an indication may comprise, for example, the signature of the reviewer.

Since it is possible for a locate technician to create a manifest without ever visiting the dig area, it may be desirable to verify that a locate operation was actually performed in the dig area, as discussed herein. According to one exemplary implementation, this may be accomplished by verifying that location information logged by a user device comports with a location where the locate operation was to be performed (e.g., the dig area) and/or that time information logged by a user device comports with a time frame for performing the locate operation (e.g., within 48 hours of the ticket being issued). The time and/or location information may be generated by the user device and automatically logged to the electronic manifest. Alternatively, the time and/or location information may be generated by the locate and/or marking device, transmitted to the user device, and automatically logged to the electronic manifest. The time information may comprise, for example, a time stamp generated by a clock internal to the user device or the locate and/or marking device. Such a time stamp may comprise a date and/or time indicative of when the locate operation was performed. The location information may comprise, for example, GPS coordinates or GPS-derived data such as a city, state, county, and/or address indicative of where the locate operation was performed. The time and/or location information may be stored and/or transmitted as part of the marked-up image or associated data (e.g., data set 700).

Data or non-image information associated with performing the locate operation and/or creating the electronic manifest, such as time spent performing certain actions or actuations of an input or marking device, can optionally be tracked and stored by the user device. The data can be used, for example,

to determine the cost of a locate operation, verify the performance of a locate operation, determine the location of physical locate marks, and/or train the locate technician. Exemplary data that may be stored includes: a start time and/or date of the locate operation; an end time and/or date of the locate operation; a total time for marking each utility (e.g., electric, gas, cable, phone, water, recreational water, and sewer); an activity count (e.g., actuations of a marking device) associated with marking each utility; a total time or activity count for other actions (e.g., marking the property line, tie down, sketching, drawing, selecting, dragging, resizing, or performing an undo, clear or zoom); time and data associated with menu clicks, line clicks, and point clicks; image request information and information identifying the requested image; data associated with drawing lines (e.g., utility type, begin location, end location, width, and characteristic (e.g., dashed or solid)); data associated with drawing points (e.g., utility type, location, width, characteristic (e.g., symbol type)); data associated with text boxes (e.g., location, characteristic (e.g., color), and text); drawing data (e.g., start and end time, ticket number, user name and/or identification, and IP address); and location data (e.g., image centroid, ticket location, start location, and end location).

It should be appreciated that the user device described herein is merely exemplary and that other implementations of user device are possible. For example, the user device and/or certain components thereof may be integrated within a locate and/or marking device. In this case, the user device may share a display with that of the locate and/or marking device and process and store data within the locate and/or marking device.

CONCLUSION

Aspects of the invention as described herein enable retrieving from a database the appropriate input image of a specific geographic location, or dig area, where locate operations are to be conducted for underground facilities. The user may draft, on the retrieved image, a variety of features, including but not limited to (1) the type of underground facilities marked using an appropriate color or other coding schema, (2) the number of underground facilities marked within the dig area, (3) the approximate geographic location of each set of underground facility locate marks, and (4) the appropriate environmental landmark offsets for each set of underground facility locate marks. The combination of the retrieved image and additional information drafted by the user may be saved in a variety of formats as an electronic manifest. Other information regarding the specific geographic location of the locate marks and environmental landmarks may be incorporated into the electronic manifest using direct input from GPS-enabled positioning tools and the like.

The foregoing description is not intended to be exhaustive or to limit the description to the precise form disclosed. Modifications and variations are possible in light of the above disclosure or may be acquired from practice of the invention.

For example, certain information was described as being presented visually on a screen of user device 210. In other implementations, this information may be audibly provided to the user. Also, particular information was described as being input via an input device 340, such as a screen of user device 210. In other implementations, this information may be provided in other ways, such as by receiving inputs via input keys and/or buttons, by recognizing speech of the user, or by monitoring a condition of the user. More particularly, the input device 340 may be capable of capturing signals that reflect a user's intent. For example, the input device 340 may

include a microphone that can capture a user's intent by capturing the user's audible commands. Alternatively, the input device 340 may interact with a device that monitors a condition of the user, such as eye movement, brain activity, or heart rate.

As another example, certain components, such as user device 210 and central server 220 were described as using an image cache. In other implementations, user device 210 and/or central server 220 may communicate with an image server (such as imager server 230) in real-time, so that no image cache may be required. In still other implementations, the user device 210 may, for example, communicate in real time with the central server 220.

As another example, it should be noted that reference to a GPS-enabled device is not limited to GPS systems only, and that any global navigation satellite system or other system that provides geo-spatial positioning may be used in implementations of the invention.

Also, while a series of blocks has been described with regard to FIG. 6, the order of the blocks may be modified in other implementations. Further, non-dependent blocks may be performed in parallel.

It will be apparent that aspects, as described above, may be implemented in many different forms of software, firmware, and hardware in the implementations illustrated in the figures. The actual software code or specialized control hardware used to implement these aspects is not limiting of the description provided herein. Thus, the operation and behavior of the aspects were described without reference to the specific software code—it being understood that software and control hardware can be designed to implement the aspects based on the description herein.

While various inventive embodiments have been described and illustrated herein, those of ordinary skill in the art will readily envision a variety of other means and/or structures for performing the function and/or obtaining the results and/or one or more of the advantages described herein, and each of such variations and/or modifications is deemed to be within the scope of the inventive embodiments described herein. More generally, those skilled in the art will readily appreciate that all parameters, dimensions, materials, and configurations described herein are meant to be exemplary and that the actual parameters, dimensions, materials, and/or configurations will depend upon the specific application or applications for which the inventive teachings is/are used. Those skilled in the art will recognize, or be able to ascertain using no more than routine experimentation, many equivalents to the specific inventive embodiments described herein. It is, therefore, to be understood that the foregoing embodiments are presented by way of example only and that, within the scope of the appended claims and equivalents thereto, inventive embodiments may be practiced otherwise than as specifically described and claimed. Inventive embodiments of the present disclosure are directed to each individual feature, system, article, material, kit, and/or method described herein. In addition, any combination of two or more such features, systems, articles, materials, kits, and/or methods, if such features, systems, articles, materials, kits, and/or methods are not mutually inconsistent, is included within the inventive scope of the present disclosure.

All definitions, as defined and used herein, should be understood to control over dictionary definitions, definitions in documents incorporated by reference, and/or ordinary meanings of the defined terms.

The indefinite articles “a” and “an,” as used herein in the specification and in the claims, unless clearly indicated to the contrary, should be understood to mean “at least one.”

The phrase “and/or,” as used herein in the specification and in the claims, should be understood to mean “either or both” of the elements so conjoined, i.e., elements that are conjunctively present in some cases and disjunctively present in other cases. Multiple elements listed with “and/or” should be construed in the same fashion, i.e., “one or more” of the elements so conjoined. Other elements may optionally be present other than the elements specifically identified by the “and/or” clause, whether related or unrelated to those elements specifically identified. Thus, as a non-limiting example, a reference to “A and/or B”, when used in conjunction with open-ended language such as “comprising” can refer, in one embodiment, to A only (optionally including elements other than B); in another embodiment, to B only (optionally including elements other than A); in yet another embodiment, to both A and B (optionally including other elements); etc.

As used herein in the specification and in the claims, “or” should be understood to have the same meaning as “and/or” as defined above. For example, when separating items in a list, “or” or “and/or” shall be interpreted as being inclusive, i.e., the inclusion of at least one, but also including more than one, of a number or list of elements, and, optionally, additional unlisted items. Only terms clearly indicated to the contrary, such as “only one of” or “exactly one of,” or, when used in the claims, “consisting of,” will refer to the inclusion of exactly one element of a number or list of elements. In general, the term “or” as used herein shall only be interpreted as indicating exclusive alternatives (i.e. “one or the other but not both”) when preceded by terms of exclusivity, such as “either,” “one of,” “only one of,” or “exactly one of.” “Consisting essentially of,” when used in the claims, shall have its ordinary meaning as used in the field of patent law.

As used herein in the specification and in the claims, the phrase “at least one,” in reference to a list of one or more elements, should be understood to mean at least one element selected from any one or more of the elements in the list of elements, but not necessarily including at least one of each and every element specifically listed within the list of elements and not excluding any combinations of elements in the list of elements. This definition also allows that elements may optionally be present other than the elements specifically identified within the list of elements to which the phrase “at least one” refers, whether related or unrelated to those elements specifically identified. Thus, as a non-limiting example, “at least one of A and B” (or, equivalently, “at least one of A or B,” or, equivalently “at least one of A and/or B”) can refer, in one embodiment, to at least one, optionally including more than one, A, with no B present (and optionally including elements other than B); in another embodiment, to at least one, optionally including more than one, B, with no A present (and optionally including elements other than A); in yet another embodiment, to at least one, optionally including more than one, A, and at least one, optionally including more than one, B (and optionally including other elements); etc.

It should also be understood that, unless clearly indicated to the contrary, in any methods claimed herein that include more than one step or act, the order of the steps or acts of the method is not necessarily limited to the order in which the steps or acts of the method are recited.

In the claims, as well as in the specification above, all transitional phrases such as “comprising,” “including,” “carrying,” “having,” “containing,” “involving,” “holding,” “composed of,” and the like are to be understood to be open-ended, i.e., to mean including but not limited to. Only the transitional phrases “consisting of” and “consisting essentially of” shall be closed or semi-closed transitional phrases,

35

respectively, as set forth in the United States Patent Office Manual of Patent Examining Procedures, Section 2111.03.

What is claimed is:

1. An apparatus for facilitating generation of a searchable electronic record of a locate operation performed by a locate technician in a dig area, wherein at least a portion of the dig area is planned to be excavated or disturbed during excavation activities, the apparatus comprising:

a communication interface;

a display device;

a memory to store processor-executable instructions; and

a processing unit coupled to the communication interface, the display device, and the memory, wherein upon execution of the processor-executable instructions by the processing unit, the processing unit:

controls the communication interface to electronically receive source data representing at least one input image of a geographic area including the dig area, wherein the source data comprises geo-encoded information relating to the geographical area;

processes the source data and controls the display device so as to display at least a portion of the at least one input image;

adds to the displayed at least one input image at least one digital representation of at least one physical locate mark so as to generate a marked-up image including the at least one digital representation of the at least one physical locate mark, the at least one physical locate mark applied to ground in the dig area by the locate technician during a locate operation comprising identifying, using the at least one physical locate mark, a presence or an absence of at least one underground facility within the dig area, wherein the processing unit:

acquires input from a marking device configured to apply the at least one physical locate mark to the dig area, the input relating to a geographic location of the at least one physical locate mark applied by the locate technician during the locate operation; and adds to the displayed at least one input image the at least one digital representation of the at least one physical locate mark, based at least in part on the input acquired from the marking device; and

further controls the communication interface and/or the memory to electronically transmit and/or electronically store information relating to the marked-up image so as to generate the searchable electronic record of the locate operation.

2. The apparatus of claim 1, in combination with the marking device, wherein the marking device comprises a GPS-enabled device.

3. The combination of claim 2, wherein the GPS-enabled device is a GPS-enabled paint wand.

4. The combination of claim 2, wherein the GPS-enabled device is a combined locating/marketing device configured to both identify an underground facility in the dig area and apply the at least one physical locate mark to the dig area.

5. The apparatus of claim 1, wherein:

the at least one input image is indexed to a coordinate system that provides geo-spatial positioning based on the geo-encoded information included in the source data; and

the processing unit processes the input acquired from the marking device based on the geo-encoded information included in the source data so as to add the at least one

36

digital representation of the at least one physical locate mark to the displayed at least one input image to generate the marked-up image.

6. The apparatus of claim 1, wherein the at least one input image comprises at least one dig area indicator to provide at least one indication of the dig area in the displayed at least one input image.

7. The apparatus of claim 1, wherein:

the at least one input image comprises at least one map of the geographic area; and

the at least one map of the geographic area includes one or more of: a street/road map, facility map illustrating at least one installed underground facility in the geographic area, a topographical map, a military map, a parcel map, a tax map, a town or county planning map, and a polygon map.

8. The apparatus of claim 1, wherein the at least one input image comprises at least one architectural, construction and/or engineering drawing or virtual rendition of the geographic area.

9. The apparatus of claim 1, wherein the at least one input image comprises at least one grid to provide representational geographic information and a reference relating to the geographic area.

10. The apparatus of claim 1, wherein:

the at least one input image comprises at least one photographic image; and

the at least one photographic image comprises one or more of a topographical image, a satellite image, and an aerial image.

11. A method for generating a searchable electronic record of a locate operation performed by a locate technician in a dig area, wherein at least a portion of the dig area is planned to be excavated or disturbed during excavation activities, the method comprising:

A) electronically receiving source data representing at least one input image of a geographic area comprising the dig area, wherein the source data comprises geo-encoded information relating to the geographical area;

B) processing the source data so as to display at least a portion of the at least one input image on a display device;

C) adding to the displayed at least one input image at least one digital representation of at least one physical locate mark so as to generate a marked-up image including the at least one digital representation of the at least one physical locate mark, the at least one physical locate mark applied to ground in the dig area by the locate technician during a locate operation comprising identifying, using the at least one physical locate mark, a presence or an absence of at least one underground facility within the dig area, wherein C) comprises:

C1) electronically receiving location information regarding a location of the at least one physical locate mark; and

C2) based at least in part on the location information received in C1), adding to the displayed at least one input image the at least one digital representation of the at least one physical locate mark; and

D) electronically transmitting and/or electronically storing information relating to the marked-up image so as to generate the searchable electronic record of the locate operation.

12. The method of claim 11, wherein the location information received in C1) includes geographic coordinates provided by a GPS-enabled device.

37

13. The method of claim 11, wherein:
 in A), the at least one input image is indexed to a coordinate system that provides geo-spatial positioning based on the geo-encoded information included in the source data; and
 C2) comprises processing the location information based on the geo-encoded information included in the source data so as to add the at least one digital representation of the at least one physical locate mark to the displayed at least one input image to generate the marked-up image. 10
14. The method of claim 11, wherein the at least one input image comprises at least one dig area indicator to provide at least one indication of the dig area in the displayed at least one input image.
15. The method of claim 11, wherein: 15
 the at least one input image comprises at least one map of the geographic area; and
 the at least one map of the geographic area includes one or more of: a street/road map, a facility map illustrating at least one installed underground facility in the geographic area, a topographical map, a military map, a parcel map, a tax map, a town or county planning map, a polygon map, and a virtual map. 20
16. The method of claim 11, wherein the at least one input image comprises at least one architectural, construction and/or engineering drawing or virtual rendition of the geographic area. 25
17. The method of claim 11, wherein the at least one input image comprises at least one grid to provide representational geographic information and a reference relating to the geographic area. 30
18. The method of claim 11, wherein:
 the at least one input image comprises at least one photographic image; and
 the at least one photographic image comprises one or more of a topographical image, a satellite image, and an aerial image. 35
19. At least one non-transitory computer-readable storage medium encoded with instructions that, when executed on at least one processing unit, perform a method for generating a

38

- searchable electronic record of a locate operation performed by a locate technician in a dig area, wherein at least a portion of the dig area is planned to be excavated or disturbed during excavation activities, the method comprising:
- 5 A) electronically receiving source data representing at least one input image of a geographic area comprising the dig area, wherein the source data comprises geo-encoded information relating to the geographical area;
 B) processing the source data so as to display at least a portion of the at least one input image on a display device;
 C) adding to the displayed at least one input image at least one digital representation of at least one physical locate mark so as to generate a marked-up image including the at least one digital representation of the at least one physical locate mark, the at least one physical locate mark applied to ground in the dig area by the locate technician during a locate operation comprising identifying, using the at least one physical locate mark, a presence or an absence of at least one underground facility within the dig area, wherein C) comprises:
 C1) electronically receiving location information regarding a location of the at least one physical locate mark, wherein the location information includes geographic coordinates provided by a GPS-enabled device; and
 C2) based at least in part on the location information received in C1), adding to the displayed at least one input image the at least one digital representation of the at least one physical locate mark; and
 D) electronically transmitting and/or electronically storing information relating to the marked-up image so as to generate the searchable electronic record of the locate operation.
20. The at least one medium of claim 19, wherein the at least one input image comprises at least one dig area indicator to provide at least one indication of the dig area in the displayed at least one input image.

* * * * *